A Model for Management of Patients With Stroke During the Acute Phase
Outcome and Economic Implications

Ib R. Odderson, MD, PhD; Bev S. McKenna, MN, RN

Background and Purpose: The purpose of the study was to develop a clinical pathway for patients with nonhemorrhagic stroke during the acute hospital phase to improve the quality of care and reduce costs.

Methods: The pathway included standard admission orders and a swallow screen on day 1 of hospitalization. Physical therapy, occupational therapy, speech therapy, and social worker assessments were done on day 2. A physiatry consult was performed on day 3 if indicated, and by day 4 a discharge target date and disposition were addressed.

Results: Outcomes for 121 patients during the first year of pathway implementation are reported. The average length of stay on the acute service decreased from 10.9 days to 7.3 days (P<.05), reducing the charges per patient by 14.6%. Complications in the form of urinary tract infections and aspiration pneumonia rates decreased by 63.2% (P<.05) and 38.7%, respectively.

Conclusions: We conclude that the implementation of a clinical pathway for patients with acute, nonhemorrhagic stroke resulted in a significant reduction in length of stay, charges, and complications while improving the quality of care. (Stroke. 1993;24:1823-1827.)

KEY WORDS • hospitalization • rehabilitation • stroke management • stroke outcome

Before 1982, hospital reimbursement by Medicare was based on a retrospective payment system. This was drastically changed in 1983 by introduction of the present prospective payment system (PPS), where hospitals are paid a flat rate based on one of the 492 diagnostic related groups (DRG).1

For DRG 0-014 (cerebrovascular accident [CVA]), the yearly increase in Medicare payments to Seattle area hospitals from 1986 to 1992 (1.0% per year) has not been keeping up with the annual inflation rate for this area (4.0% per year).2 During the same time period the Health Care Finance Administration recommended a reduction in length of stay from 8.5 days to 7 days.

In response to the DRG-based PPS, Overlake Hospital Medical Center designed a prospective managed care system. A clinical pathway is being developed for each DRG in which the DRG reimbursement is less than the hospital charges, the volume of patients poses a significant financial burden to the hospital, the patient population is at high risk of complications, and/or patient management challenges the Overlake Hospital Medical Center staff.3 This article describes the clinical pathway developed for acute care management of patients with nonhemorrhagic stroke (DRG 0-114) and the results of its implementation.

The purposes of the study were (1) to improve and standardize quality of care for patients with stroke by developing a clinical pathway, (2) to reduce length of stay to 7 days, (3) to minimize complications, (4) to coordinate resource utilization and care provision, and (5) to reduce charges.

Subjects and Methods

The study was performed at Overlake Hospital Medical Center, a 257-bed urban community hospital in Bellevue, Wash. Two multidisciplinary teams were coordinated by the director of clinical systems (B.S.M.) to develop the clinical pathway. One team consisted of clinical specialists, managers, and staff from nursing, physical therapy, occupational therapy, speech therapy, and nutritional services. The other team was made up of representative physician specialists caring for stroke patients (emergency medicine, internal medicine, family practice, neurology, psychiatry, and physical medicine and rehabilitation). These teams collaborated in development of the pathway content based on case review, community standards, literature review, and practice experience. The pathway specified timed, sequential outcome and intervention for each day of hospital stay. All screens and consultations are included in the standard admission orders. The salient pathway events are as follows:

Day 1: Standing stroke clinical pathway orders are used on admission (Fig 1). A swallow screen is performed by speech therapist or certified nurse, and a
nutritional screen is completed. Patient and family education material is also provided.

Day 2: Physical therapy/occupational therapy/speech therapy screens and medical social worker assessment are performed. Dietary consult is completed if indicated by nutritional screen.

Day 3: Psychiatrist consult is performed if indicated by the physical therapy/occupational therapy screen. This consult is requested through standard admission orders.

Day 4: A target discharge date and disposition are identified, and video education is provided for patient and family (Billy Budd Films, Wyckiff, NY; Attaching Group, Evanston, IL).

Day 5: A decision is made regarding the need for alternative nutritional support such as percutaneous gastrostomy tube (PEG).

Day 6: Discharge equipment is ordered by therapists, and video education is provided for patient and family.

Day 7: Discharge or transfer to inpatient rehabilitation medicine or other service is accomplished.

To improve and standardize the quality of care, the standard admission orders included specific strategies to prevent complications such as deep venous thrombosis, urinary tract infection (UTI), aspiration pneumonia, and constipation. Foley catheters were placed only in comatose patients, and postvoid residuals were assessed by ultrasound to prevent unnecessary catheterizations. The patients had nothing by mouth until swallow dysfunction was assessed by speech therapist or certified registered nurse. Antithrombotic stockings were standard, and pneumatic compressive stockings were optional on the admission orders. A standard bowel program was also initiated. A physiatry consultation was obtained if the patient, when assessed by the physical and occupational therapy staff, met any of the following criteria: the patient had functional deficits that prevented return to former living situation, would benefit from coordination of therapies and assistance with discharge, or would potentially benefit from inpatient rehabilitation.

An admission diagnosis of CVA, rule out CVA, or transient ischemic attack with physical or cognitive deficits at the time of admission to the department was used as the criterion for inclusion in the stroke pathway. Patients excluded from the clinical pathway were those with a diagnosis of CVA with terminal comfort care only at the time of admission. The stroke pathway was discontinued for patients who had resolution of the deficits within 24 hours of admission and for those in whom a diagnosis of acute nonhemorrhagic stroke was ruled out.

**Statistical Analysis**

Statistical analyses were performed using $\chi^2$ for evaluating differences in the number of UTIs and aspiration pneumonias. Differences between means for length of stay and charges were evaluated by a one-way analysis of variance. A $t$ test was used for determining differences in length of stay for PEG patients. All means are expressed as ±1 SEM, and a value of $P<.05$ was considered statistically significant.

**Results**

A total of 121 patients were admitted with the diagnosis of nonhemorrhagic stroke (DRG 0-014) dur-
Fig 2. Bar graph shows average length of stay (LOS) for acute care of patients with nonhemorrhagic stroke. Data are mean±SEM.

ing the first year of implementation of the pathway (June 1, 1991, to May 31, 1992) compared with 80 and 90 patients during 1989 and 1990, respectively. Because of the exclusion criteria only 75 patients remained on the pathway. However, we have included all 121 patients in the pathway data because these exclusion criteria were not in effect for the comparison years. The length of stay during the pathway year (7.3±0.5 days) was significantly reduced (P<.05) compared with 1989 (10.9±1.2 days) but not compared with 1990 (9.8±0.9 days) (Fig 2). Interestingly, the maximal length of stay gradually decreased from 63 days in 1989 to 48 days in 1990 and 29 days in the pathway year. The average age of patients changed minimally: 75.9 years in 1989, 74.5 years in 1990, and 73.9 in the pathway year.

The average charges were reduced by 14.6% per patient during the pathway year compared with 1990, but this was not a statistically significant difference (Fig 3). However, the contractual loss was decreased by 28.6% per patient for Medicare and non-Medicare combined during the pathway year compared with 1990. The difference between Medicare and non-Medicare charges was reduced for the pathway year.

The number of UTIs during the pathway year (6.6%) was significantly decreased compared with 1990 (18.0%, P<.05). The length of stay for patients with UTIs decreased from 15.3±2 days to 14.8±2.8 days. The number of aspiration pneumonias decreased from 6.7% to 4.1% but was not statistically significant because of the small numbers. The length of stay for patients with aspiration pneumonia decreased from 17.5±6.5 to 12.8±2.2 days.

The disposition of the patients after the acute care stay did not change significantly for the pathway year compared with previous years (Fig 4, top panel).

Percutaneous gastrostomy tubes were placed in 8.9% of the patients in 1990 and 8.3% of patients during the pathway year (P=NS). The length of stay for patients

### Table: Percentage of Stroke Pathway Patients Assessed and Treated

<table>
<thead>
<tr>
<th>Consultation</th>
<th>Assessed, %</th>
<th>Treated, % of assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech therapy</td>
<td>87</td>
<td>61</td>
</tr>
<tr>
<td>Physical therapy</td>
<td>87</td>
<td>77</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>87</td>
<td>77</td>
</tr>
<tr>
<td>Nutrition</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>Social worker</td>
<td>89</td>
<td>83</td>
</tr>
<tr>
<td>Neurology</td>
<td>70</td>
<td>96</td>
</tr>
<tr>
<td>Physical medicine and rehabilitation</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>Chaplain</td>
<td>2</td>
<td>100</td>
</tr>
</tbody>
</table>

Assessed indicates 1 contact; treated, >1 contact.
receiving PEGs decreased from 25.6±4.7 days to 15.9±1.8 days ($P=0.05$) during the pathway year. None of the patients with PEGs were discharged to home, and the disposition remained unchanged for the 2 years (Fig 4, bottom panel).

The percentage of pathway patients assessed and treated is shown in the Table.

**Discussion**

We have found that the development and implementation of a clinical pathway for patients with stroke during the acute hospital phase can positively affect outcome in the form of reductions in length of stay, charges, and complications while improving and standardizing the quality of care.

The most unique feature of the pathway is the immediate application of a rehabilitation medicine approach to patient management at the time of admission of stroke patients. Any delay in starting rehabilitation therapy has been circumvented by having the rehabilitation therapists see and evaluate the patients on days 1 and 2 before any physiatry consultation. Typically, when a physical medicine and rehabilitation consultation is obtained, the patient will be assessed the following day by the therapist and treatment will ensue on the third day or later.\(^4\) Eliminating such a delay has been the focus of a recent study.\(^7\) By delaying the physiatry consultation to the third day, unnecessary consultation and charges for patients with transient ischemic attacks are avoided. Only 62% of the patients required a physiatry consultation, and slightly more than half of these were seen more than once. The number of physiatry consultations in our study is similar to that for conventional referral by attending physicians.\(^4\) In our study, a larger number of patients required rehabilitation therapy than physiatry consultations. The number of managed clinical pathway patients treated by physical, occupational, or speech therapy (67%, 67%, and 53%, respectively) is thus larger than that reported by Dombov et al in 1987\(^4\) (51%, 41%, and 13%, respectively), in which case a physiatry consultation was required before beginning rehabilitation therapies. We conclude, therefore, that if a physiatry consultation is required before rehabilitation therapy, a substantial number of patients with stroke are likely to be inadequately treated.

By implementing the clinical pathway we achieved compliance with the Health Care Finance Administration recommendations for length of stay of 7.4 days for DRG 0-014 in 1991. However, our study was for a select group of stroke patients and did not include hemorrhagic CVA, which often involves a grimmer prognosis and slower recovery.\(^5,7\) We recognize that DRG 0-014 may be too broad a category for appropriate management guidelines and reimbursement purposes because stroke outcome varies widely for occlusive disease versus hemorrhagic CVA.

The quality of care was improved, as demonstrated by a reduction in number of UTIs and aspiration pneumonias. The importance of prevention of complications is emphasized by the longer stays for patients who developed UTI (average length of stay, 14.8 days) and aspiration pneumonia (average length of stay, 12.8 days). The reduction in UTIs is attributed to the use of bladder ultrasound equipment for determination of postvoid residuals, leading to fewer catheterizations. The rate of infection has been shown to increase with the number of catheterizations in patients with spinal cord disorders.\(^8\) Similarly, the reduction in aspiration pneumonias is attributed to the initial swallow assessment before any oral intake. Although the number of aspiration pneumonias was reduced by 38.7%, the lack of statistical significance is attributed to the small number of occurrences (4.1%). The importance of an early dietary consultation is underscored by a recent study showing that early enteral nutrition in stroke patients is associated with a shorter length of stay.\(^9\)

The care of patients with stroke was standardized so that attending physicians, regardless of their experience with therapeutic options and previous practice, would apply the optimal management approach. This standardized approach has been of benefit to the multidisciplinary staff by reducing variation in care prescribed by different attending physicians. Minimizing variation in management of care for patients with stroke has also improved the quality of care. Similarly, for any product the less variation, the better is the quality, because it is consistently meeting the need and expectation of the customer.\(^10\) The clinical pathway resulted in other benefits, such as enhanced patient and family education with the development of an educational booklet and purchased videotapes and guidelines for prevention of complications (such as no intravenous lines in the affected limb and a standard bowel program).

To achieve acceptance by the attending physicians, the clinical pathway was introduced at grand rounds by a multidisciplinary panel. The use of standard orders on admission was in general well accepted by the attending staff and probably most enthusiastically by the relatively newer medical staff members. To reinforce voluntary compliance with the clinical pathway, outcome data for the first year were presented at medical specialty section meetings.

Despite a shorter length of stay with implementation of the clinical pathway, the disposition of patients with stroke was not adversely affected. In fact, there was a trend toward an increased number of discharges to home and fewer nursing home placements. Comparison of disposition outcome to other studies is difficult if not impossible because of differences in study populations (inclusion of all patients with stroke\(^7,11,12\) versus excluding hemorrhage\(^13\) or certain types of hemorrhage\(^14\) and method for determining discharges (all patients versus only selected dispositions\(^12,13,15\)). The percent of discharges to home in our study (45.7%) falls within the range of other studies of 28% to 84%\(^7,11,14,15\). The percentage of patients requiring institutional care varies from 0% to 44%\(^7,11,14,15\) compared with 25.0% in our study. The percentage of patients transferred to inpatient rehabilitation (16.4%) is comparable for data from the continental United States, where 4% to 18% are admitted for inpatient rehabilitation, while up to 43% are transferred in Australia.\(^14\)

At our hospital a larger number of patients received PEGs (8.3%) than reported by Kuhlemeier et al\(^10\) (2.8%) for a comparable patient population. However, their PEG patients’ mean acute length of stay was 33.3 days compared with 15.9 days for our PEG patients. We conclude that implementation of the stroke pathway resulted in a 26.8% shorter length of stay for our PEG
patients but did not affect the number of PEGs placed nor the disposition of the patients. The charge for a PEG placement is equal to 1.6 days of hospitalization and is thus easily defrayed by a shorter length of stay.

**Conclusions**

In summary, we have found that the development and implementation of a clinical pathway for patients with stroke during the acute hospital phase can positively affect outcome in the form of a reduction in length of stay, charges, and complications while improving and standardizing the quality of care. The length of stay for patients with nonhemorrhagic stroke was brought in to compliance with the Health Care Finance Administration guidelines for DRG 0-014 and the financial burden to the hospital for managing this diagnostic group reduced. However, the DRG 0-014 category may be too general, which can only be determined by additional studies.

**Acknowledgments**

We wish to thank the following at Overlake Hospital Medical Center for their contribution to the development of the clinical pathway: Twila Alexander, RN; Debbie Anderson, MSW; Becky Angelmeyer, CPAM; Mark Antush, RPh; Regina Bennett, MSW; Timothy Bone, MD; Susan Carbone, RN; Thomas Collins, MD; Sue Gadau, RD; Michelle Gheen, RN; Anne Hart, RN; John Holder, MD; Shawn Nixon, MD; Leland Teng, MD; Debra Winston-Heath, RN; Gail Ratley, RN; Nina Johnson, RN; Karen Jones, OT; Linda Lautetta, RN; Jerry Nash, MDiv; Mary Nelson, PT; and Nancy Rettig, ST.

**References**

A model for management of patients with stroke during the acute phase. Outcome and economic implications.
I R Odderson and B S McKenna

Stroke. 1993;24:1823-1827
doi: 10.1161/01.STR.24.12.1823

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/24/12/1823