Neurohospitalists Reduce Length of Stay for Patients With Ischemic Stroke

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Abstract

Background: Neurohospitalists may improve the efficiency and quality of care delivered to hospitalized patients with neurological disease. However, there is limited systematic data to support this hypothesis. The primary purpose of this study was to compare length of stay (LOS) for patients with ischemic stroke cared for by either neurohospitalists or community-based neurologists at a single institution. **Methods:** A retrospective chart review was performed for all patients with ischemic stroke discharged from St. Luke's Hospital in Jacksonville, Florida, between January 2006 and December 2007. The LOS for patients cared for by neurohospitalists was compared to the LOS for patients cared for by community neurologists. Compliance with Joint Commission inpatient stroke quality metrics was also compared. **Results:** A total of 533 patients were discharged with a principal diagnosis of ischemic stroke over the 24-month study period. Neurohospitalists cared for 313 patients with mean ($\pm$ SD) LOS of 4.9 (5.2) days (95% CI: 4.3-5.5 days), and community-based neurologists cared for 220 patients with a mean LOS of 6.5 (8.2) days (95% CI: 5.4-7.6 days). The mean LOS was significantly less for the neurohospitalists compared to the community-based neurologists ($P = .005$). Neurohospitalists achieved a higher compliance rate in 10 of 11 inpatient stroke quality metrics and achieved significantly higher compliance rate of smoking cessation education ($P = .019$). **Conclusions:** Neurohospitalists achieved significantly shorter LOS for patients with ischemic stroke compared to community-based neurologists. These data suggest that neurohospitalists can also improve compliance with quality metrics necessary for Joint Commission Primary Stroke Center designation.

Keywords

neurology hospitalist, neurohospitalist, length of stay, stroke, quality metrics

Introduction

Neurohospitalists are a rapidly growing neurological subspecialty fueled by pressures within the American health care system that demand high-quality, efficient, cost-effective inpatient care.^{1,2} Neurohospitalists, similar to internal medicine hospitalists, are pure inpatient specialists,^{1,3} free of outpatient responsibilities. The value of hospitalists to hospitals is derived in part from achieving high-quality care while simultaneously shortening the length of stay (LOS).⁴ In response to the need for cost-effective and high-quality care and the fact that many hospitals provide no additional reimbursement for call, many neurologists have dropped out of inpatient and emergency department (ED) call structures.⁵ More hospitals are now hiring neurohospitalists¹ to provide timely evaluation of patients with stroke needed to maintain Primary Stroke Center designations.^{6,7}

This study's primary purpose was to compare LOS for patients with ischemic stroke cared for by neurohospitalists to community-based neurologists at a single institution.

Methods

After institutional review board (IRB) approval, we retrospectively reviewed the medical records of all patients with ischemic stroke discharged between January 2006 and December 2007 from St. Luke's Hospital located in Jacksonville, Florida, a designated Primary Stroke Center by the Joint Commission,⁸ and a Comprehensive Stroke Center by the Florida Agency for Healthcare Administration. Those patients

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Table 1. Characteristics of Patients With Ischemic Stroke Cared for by Neurohospitalists and Community-Based Neurologists at St. Luke's Hospital^a

Characteristic	Neurohospitalists	Community Neurologists	P Value
Patients, n	313	220	
Mean age, years (range)	71.9 (26-96)	73.6 (36-102)	.19
Male, n (%)	166 (53%)	83 (38%)	<.001 ^b
Mean LOS (SD), days	4.9 (5.2)	6.5 (8.2)	.005

^a P values calculated with independent samples student t test.

^b P value calculated with chi-square test of association.

with a principal diagnosis of ischemic stroke as defined by the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* were included in the analysis.

St. Luke's Hospital rotated ED neurology call responsibility on an alternating day schedule for unassigned patients (ie, patients who did not have established medical care with a provider) between 2 neurology groups: a neurohospitalist group affiliated with Mayo Clinic and a community-based neurology group. The primary clinical responsibility of the neurohospitalists was to provide care for neurological patients admitted to the hospital or ED, without competing outpatient responsibilities. In contrast, the community-based neurologists had shared clinical responsibilities that included office hours in outpatient clinics along with inpatient care. Both groups had the ability to admit patients primarily to a neurology service or provide consultative services to the ED or to other subspecialties within the hospital. Length of stay was measured in days and calculated from the date of admission until the date of discharge. The 95% confidence interval was calculated for the mean LOS for patients with ischemic stroke cared for by neurohospitalists and community-based neurologists. Continuous variables were compared with the independent samples *t* test and categorical variables were tested for association with chi-square test statistics.

Compliance with the 11 inpatient stroke quality metrics necessary for maintenance of Primary Stroke Center certification was reviewed.⁹ In accordance with Joint Commission sampling methodology, charts were selected from the ischemic stroke patients admitted to St. Luke's Hospital. This sampling methodology resulted in chart review of approximately 85% of patients admitted during the study period. The metrics included dysphagia screening prior to oral medications or diet, lipid profile, tissue plasminogen activator (tPA) considered, tPA administered, antithrombotic agent given (antiplatelet or anticoagulation) within 48 hours of admission, deep vein thrombosis prophylaxis, antithrombotic by discharge, anticoagulation for atrial fibrillation, stroke education, smoking cessation information, and plan for rehabilitation. The proportion of patients with documented completion of the applicable stroke quality metric was compared between the neurohospitalists and community-based neurologists within each category.

Results

A total of 533 patients were discharged from St. Luke's Hospital with a diagnosis of ischemic stroke over the 24-month

study period. The demographic data are summarized in Table 1. Neurohospitalists cared for 313 patients with mean ($\pm$ S.D.) LOS of 4.9 (5.2) days (95% CI: 4.3-5.5 days) and community-based neurologists cared for 220 patients with a mean ($\pm$ S.D.) LOS of 6.5 (8.2) days (95% CI: 5.4-7.6 days). The mean LOS was significantly less for the neurohospitalists compared to the community-based neurologists ($P = .005$). There were no significant differences in age between the 2 groups, although there were significantly more males in the neurohospitalist cohort.

Neurohospitalists achieved a higher compliance rate in 10 of 11 Joint Commission inpatient stroke quality metrics. Neurohospitalists achieved a significantly higher compliance rate for smoking cessation education ($P = .019$, and administration of intravenous tPA ($P < .001$) but the other measures not being statistically significant (Table 2).

Discussion

Neurohospitalists provided care for patients having ischemic stroke with a significantly reduced LOS compared to community-based neurologists. Simultaneously, neurohospitalists achieved higher compliance rates with inpatient stroke quality metrics necessary for Joint Commission Primary Stroke Center certification. This is the first data-driven study focusing on the benefits of neurohospitalists.

Neurohospitalists as site-based specialists are devoid of outpatient responsibilities, which give them more time to respond to ED and hospital consultations than non-neurohospitalists.^{1,2,6,7} Neurohospitalists, similar to internal medicine hospitalists, may better utilize "systems of care" such as the finding case managers and standardized order sets. They may also have more organizational experience and efficiency with time.⁴ Neurohospitalists can also make an outpatient neurology practice more efficient by virtue of minimizing emergent inpatient and ED consultations that would otherwise lead to canceled appointments and procedures. In effect, this would minimize emergent inpatient and ED consultations of community neurologists. In the current study, community-based neurologists admitted or consulted on patients when feasible during clinic time or deferred inpatient responsibilities until after clinic. Not all practices can support a neurohospitalist due to insufficient inpatient volumes, but this data should further encourage hospitals to consider this model.

Table 2. Compliance With Joint Commission⁹ Inpatient Stroke Quality Metrics^a

Joint Commission Metric	Neurohospitalists	Community Neurologists	P Value
Dysphagia screening	103/150 (68.7%)	73/112 (65.2%)	.552
Lipid profile	141/151 (93.4%)	103/114 (90.4%)	.366
IV tPA considered ^b	66/67 (98.5%)	24/25 (96%)	.463
IV tPA given ^c	37/38 (97.4%)	0/1 (0%)	<.001
Antithrombotic <48 hours	111/118 (94.1%)	107/112 (95.5%)	.617
DVT prophylaxis	93/105 (88.6%)	92/105 (87.6%)	.831
Antithrombotic at discharge	140/142 (98.6%)	103/105 (98.1%)	.760
Anticoagulation for atrial fibrillation	19/20 (95%)	10/12 (83.3%)	.273
Stroke education	136/153 (88.9%)	97/116 (83.6%)	.209
Smoking cessation education	29/29 (100%)	19/23 (82.6%)	.019
Plan for rehabilitation	147/152 (96.7%)	112/116 (96.6%)	.943

Abbreviations: DVT, deep vein thrombosis; IV, intravenous; tPA, tissue plasminogen activator.

^a P values were calculated with chi-square test of association. The data indicate the ratio of compliant stroke metric (numerator) over the applicable stroke metric (denominator). For example, not all patients smoked and thus the denominator data is lower than the total number of patients admitted for each group. Further details of this methodology are outlined at the Joint Commission Web site⁸ and document.⁹

^b tPA considered applied to patients who were within the 3-hour window with stroke.

^c tPA given was a subset of the "tPA considered group" and applied to patients who met inclusion/exclusion criteria and drug given.

Limitations of this study included the sampling process by which the 11 Joint Commission metrics were measured, which could theoretically lead to a study bias. However, the current sampling method captured approximately 85% of all patients with stroke at our hospital. A major limitation of the current study includes the lack of National Institutes of Health Stroke Scale (NIHSS)-adjusted and comorbidity-adjusted LOS in these patients. However, the current study while limited is still the first comparing a neurohospitalist model of stroke care versus community neurologist stroke care. Future studies should study demographic and NIHSS-adjusted morbidity accordingly to validate or refute this observation. Other limitations include the retrospective design, single center, lack of control for clinical severity, and other complications like pneumonia. These variables were not the primary endpoint of the study, which was LOS, and are important for future study design.

The current study is unique in that hospital evenly rotated stroke call on alternating days, which provides a real-life experience that should in theory distribute stroke severity and comorbid conditions evenly. However, we suspect that there was uneven distribution of admissions between groups based on the higher percentage of males found in the neurohospitalist group, which is explained by the smaller size of the comparison (community) group. The epidemiological explanation is that a small comparison group presumably lead to poor randomization (by alternating ED stroke call), with the neurohospitalist group being assigned more males.

Length of stay was the primary endpoint for our study and is a commonly reported metric within the hospitalist literature, yet dependent upon many variables during hospitalization.⁶ Future studies should be designed to account for disease severity as well as outcomes. Other limitations include the lack of comparing use of standardized order sets between the groups and discharge destination (eg, nursing home or rehabilitation).

Another limitation of the current study is the uneven distribution of patients admitted for stroke who were tPA-eligible.

However, it is important to note this was a "real-world" call scenario that emerged between the community-based neurologists who called the neurohospitalist group to evaluate patients (during their call) for emergent tPA evaluation. While this was not initially anticipated, given the even rotation in ED call responsibility, this did shift more patients to being evaluated and treated with tPA to the neurohospitalist group. The neurohospitalist group was asked by community group to evaluate patients for tPA because community physicians often were in clinic during the day and did not want to disrupt their clinic schedule. Also nighttime and weekend evaluations were deferred to the neurohospitalist group because of their availability and comments from community neurologists about litigation concerns and limited reimbursement for their effort. We did not systematically evaluate the comfort of evaluating patients for tPA between groups, but acknowledge this as an important step in future comparison studies. We also acknowledge the disparate rates in tPA administration as a limitation of the study. However, this finding¹⁰ is not new and in fact been observed in community hospitals in which neurohospitalists raise the rate of tPA administration by as much as 25%. We also feel this underscores a complex problem about nationally low rates of tPA administration. For example, Kleindorfer et al¹¹ demonstrated 64% of US hospitals did not report giving tPA at all within a 2-year period despite evaluating eligible patients. The authors also showed 40% of the US population resides within counties without a hospital that administered tPA to a minimum of 2.4% patients with ischemic stroke, which is a conservative rate of administration. This data suggests a national problem in evaluating patients who are potentially eligible for tPA and underutilization despite more than a decade of evidence and trials supporting its use and the Food and Drug Administration (FDA) approving tPA for acute stroke. Several factors have been identified that limit tPA use including an exaggerated fear of intracranial or systemic bleeding, poor public knowledge

and delay in presentation outside the 3-hour window, physician fear of litigation, or lack of neurology coverage willing to evaluate patients in the ED.^{1,2,6} While patients treated with tPA within the neurohospitalist group could have theoretically led to better outcomes and shorter LOS, these patients were transferred back to the referring community-based group after a 24-hour period of ICU observation, assuming no complications such as intracranial hemorrhage. The neurohospitalist group represented an academic group with residents who often made the initial evaluation with the attending neurohospitalist. The presence of the resident while potentially representing a resource difference between groups required the presence of the attending neurohospitalist during tPA evaluation and did not act independent of the attending. We do not feel residents lead to the disparate tPA administration rates because the decision to administer tPA came from the attending physicians in either group. Neurohospitalists either in isolation or in cooperation with community neurologists helped achieve a higher rate of tPA administration, which we feel reflects the state of a national problem of providers willing to evaluate patients for acute stroke with tPA.^{1,2,6} We are reluctant to draw further conclusions about differences in tPA administration rates among the 2 groups. More research is needed about the processes of tPA administration and use including the use of neurohospitalists.

To our knowledge, this is the first study providing evidence by which neurohospitalists deliver high-quality, efficient stroke care.^{1,2} Further studies are needed to assess the mechanisms by which neurohospitalists obtain inpatient efficiency for stroke patients and to test this model of patient care in a variety of diverse settings such as patient safety and other quality metrics.

Authors' Note

Dr Barrett performed the statistical analysis.

Declaration of Conflicting Interests

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