Avoidable 30-Day Readmissions Among Patients With Stroke and Other Cerebrovascular Disease

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Fadi Nahab, MD¹, Jennifer Takesaka, MD¹, Eugene Mailyan, MD¹,
Lilith Judd, MD¹, Steven Culler, PhD², Adam Webb, MD¹,
Michael Frankel, MD¹, Dennis Choi, MD, PhD³, and
Sandra Helmers, MD, MPH¹

Abstract

Background: There are limited data on factors associated with 30-day readmissions and the frequency of avoidable readmissions among patients with stroke and other cerebrovascular disease. **Methods:** University HealthSystem Consortium (UHC) database records were used to identify patients discharged with a diagnosis of stroke or other cerebrovascular disease at a university hospital from January 1, 2007 to December 31, 2009 and readmitted within 30 days to the index hospital. Logistic regression models were used to identify patient and clinical characteristics associated with 30-day readmission. Two neurologists performed chart reviews on readmissions to identify avoidable cases. **Results:** Of 2706 patients discharged during the study period, 174 patients had 178 readmissions (6.4%) within 30 days. The only factor associated with 30-day readmission was the index length of stay >10 days (vs <5 days; odds ratio [OR] 2.3, 95% CI [1.4, 3.7]). Of 174 patients readmitted within 30 days (median time to readmission 10 days), 92 (53%) were considered avoidable readmissions including 38 (41%) readmitted for elective procedures within 30 days of discharge, 27 (29%) readmitted after inadequate outpatient care coordination, 15 (16%) readmitted after incomplete initial evaluations, 8 (9%) readmitted due to delayed palliative care consultation, and 4 (4%) readmitted after being discharged with inadequate discharge instructions. Only 5% of the readmitted patients had outpatient follow-up recommended within 1 week. **Conclusions:** More than half of the 30-day readmissions were considered avoidable. Coordinated timing of elective procedures and earlier outpatient follow-up may prevent the majority of avoidable readmissions among patients with stroke and other cerebrovascular disease.

Keywords

stroke, patient readmission, outcome assessment (health care)

Introduction

Stroke is a major cause of hospitalization in the elderly individuals and is estimated to affect 795 000 people per year in the United States.^{1,2} Recently, attention has turned to reducing hospital readmission as a way to drive improved quality of care and reduce health care costs as evidenced by the decision of the Center for Medicare and Medicaid Services (CMS) to publicly report hospital-specific, risk-adjusted readmission rates for certain conditions.³ While many patients are hospitalized annually for stroke and other cerebrovascular diseases, there are limited data on factors associated with 30-day hospital readmission and the frequency of preventable readmissions in this patient population. The objective of this study was to determine factors associated with 30-day hospital readmission at a university-based teaching hospital and to evaluate the frequency and factors contributing to avoidable readmissions.

Methods

Study Population

University HealthSystem Consortium (UHC) database records were used to retrospectively identify all patients discharged with a diagnosis of stroke or other cerebrovascular disease (*International Classification of Diseases, Ninth Revision*

¹ Department of Neurology, Emory University, Atlanta, GA, USA

² Department of Health Policy and Management, Rollins School of Public Health, Emory University, Atlanta, GA, USA

³ Simons Foundation, New York, NY, USA

Corresponding Author:

Fadi Nahab, Department of Neurology, 1365 Clifton Road, Clinic A, 3rd Floor, A3429, Atlanta, GA 30322, USA
Email: fnahab@emory.edu

[ICD-9] codes 430-438, 671.5, 674.0, 997.02) at Emory University Hospital from January 1, 2007 to December 31, 2009. Emory University Hospital is a university-based, Joint Commission-accredited primary stroke center and tertiary care referral center located in Atlanta, Georgia. Records from UHC were then used to identify patients who were readmitted to the index hospital within 30 days for any diagnosis. Patients who were readmitted for rehabilitation, chemotherapy, radiation therapy, dialysis, and delivery/birth were excluded from the 30-day readmission rate. Patients who died during their initial hospitalization were excluded from this analysis. We reviewed all readmissions for elective procedures and considered them avoidable only when there was no medical indication to delay the procedure beyond the index hospitalization.

Standard Protocol Approvals, Registrations, and Patient Consents

The study methods have been reviewed and approved by the local institutional board.

Evaluation for Avoidable Readmissions

All readmission cases during the study period were reviewed by 2 physicians including a vascular neurologist to identify readmissions that were considered avoidable. For patients with multiple 30-day readmissions, only the first 30-day readmission was included in this analysis. We defined patients with avoidable readmissions as those patients whose primary diagnosis for readmission was considered the direct result of modifiable factors during the index hospitalization and included the following categories: (1) readmissions related to elective procedures were defined as planned readmissions to the hospital exclusively to perform a nonurgent procedure without documentation of a medical or surgical reason for a delay in the procedure; (2) readmissions related to lack of early outpatient follow-up were defined as cases in which an expedited outpatient follow-up could have addressed ongoing medical (eg, headache treatment) or surgical issues (eg, wound care) at the time of discharge; (3) readmissions resulting from a delay in palliative care consultation were defined as cases where hospice-eligible patients at the time of discharge did not have any documented consultation or discussion with palliative care during the index hospitalization and were readmitted for hospice placement; (4) readmissions related to lack of clear discharge instructions were defined as cases where a lack of communication between the discharging service and either the patient or the accepting service prompted the readmission; and (5) readmissions related to an incomplete evaluation were defined as cases where diagnostic testing, rehabilitation evaluation, or treatment of active symptoms during the index visit was not completed.

Ascertainment of Outpatient Follow-Up. For all patients readmitted within 30 days, index hospitalization discharge

summaries were reviewed to identify the frequency of recommended outpatient follow-up in our stroke clinic (neurology or neurosurgery) and recommended time frames for follow-up. Outpatient follow-up appointments were considered to be scheduled prior to discharge when appointment dates were documented in the discharge summary.

Data Analysis

All statistical analyses were performed using SAS version 9.2. Comparison of baseline characteristics were performed between the readmitted and non-readmitted groups using the independent groups *t* test (for continuous variables) and chi-square test (for binary variables). Readmission rates among specialties were compared using chi-square test. Logistic regression models were used to calculate odds ratios (ORs) in multivariable models, and the 95% confidence intervals (CIs) were adjusted using the Wald statistic to identify factors associated with 30-day readmission.

Results

Of 2706 patients discharged with a diagnosis of stroke or other cerebrovascular disease during the study period, 174 patients (6.4%) had 178 readmissions within 30 days to the same hospital. Readmitted patients had median length of stay for their index hospitalization of 5 days (range 1-244 days, interquartile range 3-13 days). Baseline characteristics between patients with and without a 30-day readmission are shown in the Table 1. There was no significant difference in age, sex, race, primary diagnosis, discharging specialty, weekend discharge, and year of discharge. In multivariable analysis, the only factor associated with a 30-day readmission was index length of stay >10 days (vs <5 days; OR 2.3, 95% CI 1.4-3.7).

The discharging providers for the index hospitalization included neurology (39.7%), neurosurgery (33.3%), vascular surgery (15.5%), internal medicine (5.2%), and cardiology (4%). Overall, there was no significant difference between readmission rates among the various specialties though among non-surgical specialties, neurology discharge was associated with a trend toward lower 30-day readmission rate than other nonsurgical specialties (neurology 5.6% and other 9.1%, *P* = .09).

Avoidable Readmissions

Of the 174 patients readmitted within 30 days, 92 (53%) were classified as avoidable (Figure 1). These included 38 (41%) readmissions for elective procedures within 30 days of discharge, such as carotid revascularization, cardiac stenting or bypass, and peripheral vascular procedures. All elective procedures were determined to be avoidable as there was no medical or surgical indication to delay the procedure beyond the index hospitalization. There were 27 (29%) readmissions related to inadequate outpatient care coordination such as patients with elevated renal or liver function tests who needed

Table 1. Baseline Characteristics of Study Population^a

Characteristic	Total Population (N = 2706)	Readmitted ≤ 30 days		P Value
		Yes (N = 174)	No (N = 2532)	
Age, years	61.8 ± 16.6	61.1 ± 17.0	61.9 ± 16.5	.554
Sex, Male	1,242 (45.9%)	72 (41.4%)	1170 (46.2%)	.238
Race				
Black	882 (32.6%)	62 (35.6%)	820 (32.4%)	.196
White	1474 (54.5%)	97 (55.8%)	1377 (54.4%)	
Other	350 (12.9%)	15 (8.6%)	335 (13.2%)	
Diagnosis				
Ischemic stroke	945 (34.9%)	58 (33.3%)	887 (35.0%)	0.580
Intracerebral hemorrhage	425 (15.7%)	24 (13.8%)	401 (15.8%)	
Subarachnoid hemorrhage	666 (24.6%)	45 (25.9%)	621 (24.5%)	
TIA	198 (7.3%)	10 (5.8%)	188 (7.4%)	
Other cerebrovascular disease	472 (17.4%)	37 (21.3%)	435 (17.2%)	
Discharge specialty provider				
Neurology	1232 (45.6%)	69 (39.7%)	1163 (46.0%)	0.130
Neurosurgery	829 (30.7%)	58 (33.3%)	771 (30.5%)	
Vascular surgery	370 (13.7%)	27 (15.5%)	343 (13.6%)	
Internal medicine	91 (3.4%)	9 (5.2%)	82 (3.2%)	
Cardiology	84 (3.1%)	7 (4.0%)	77 (3.0%)	
Cardiothoracic surgery	3 (0.1%)	1 (0.6%)	2 (0.1%)	
Other	94 (3.5%)	3 (1.7%)	91 (3.6%)	
Discharge year				
2007	885 (32.7%)	52 (29.9%)	833 (32.9%)	0.187
2008	887 (32.8%)	68 (39.1%)	819 (32.4%)	
2009	934 (34.5%)	54 (31.0%)	880 (34.8%)	
Discharge day				
Monday	374 (13.8%)	28 (16.1%)	346 (13.7%)	0.465
Tuesday	487 (18.0%)	26 (14.9%)	461 (18.2%)	
Wednesday	491 (18.1%)	31 (17.8%)	460 (18.2%)	
Thursday	436 (16.1%)	32 (18.4%)	404 (16.0%)	
Friday	556 (20.6%)	40 (23.0%)	516 (20.4%)	
Saturday	252 (9.3%)	14 (8.1%)	238 (9.4%)	
Sunday	110 (4.1%)	3 (1.7%)	107 (4.2%)	

^a Values in the table are mean ± SD or N (%).

earlier outpatient laboratory monitoring and treatment or post-surgical patients who needed earlier follow-up for wound management. Other factors contributing to avoidable readmissions included 15 (16%) patients readmitted after incomplete initial evaluations, 8 (9%) patients readmitted due to delayed palliative care consultation, and 4 (4%) patients readmitted after being discharged with inadequate discharge instructions.

Readmissions and Outpatient Follow-Up

Of the 174 patients readmitted within 30 days (median time to readmission 10 days; interquartile range 3.5-18 days), 101 (58%) patients had follow-up recommended in the outpatient stroke clinic (neurology or neurosurgery), though 65% missed their first follow-up appointment. Initial follow-up was recommended within 1 month for 57% of patients and within 1 week for 5.0% of patients; only 14% had an outpatient follow-up appointment scheduled prior to discharge.

Discussion

We found that while only 6.4% of patients discharged with a diagnosis of stroke or other cerebrovascular disease during the study period were readmitted within 30 days to the same hospital, more than half of the readmissions were considered potentially avoidable. Further, 65% of patients who were readmitted within 30 days missed their recommended outpatient appointments in the stroke clinic.

Prior studies have identified various factors associated with 30-day readmission among stroke patients, including age, African American race, prior stroke or coronary artery disease, and prolonged length of stay.^{4,5} One study of patients with acute ischemic stroke found increased rates of “complicated transition,” defined as movement from a less intensive to a more intensive level of care including rehospitalization and return visits to the emergency department, in patients with increased length of stay. This same study found that age, African American race, and chronic disease were also significant

Figure 1. Factors associated with avoidable readmissions among patients with stroke and other cerebrovascular disease.

predictors of readmission, though these were not predictors in our study.⁴ We found that index length of stay greater than 10 days was the only factor associated with 30-day readmission in the multivariable analysis. As has been suggested previously, the length of stay may be a representation of disease severity with greater disease severity associated with longer index hospitalizations.⁶

Previous studies of patients with stroke have also identified a lower risk for 30-day readmission among patients discharged from neurology or neurosurgical services.^{6,7} While specialty of discharge provider was not a predictor of 30-day readmission in our multivariable analysis, we did identify a trend toward lower readmission rates for patients with stroke discharged from neurology services compared with other non-surgical specialties.

Our study found that more than half of the identified 30-day readmissions were potentially avoidable (Table 2). Elective procedures performed within 30 days of discharge from the index hospitalization contributed to the largest proportion of avoidable readmissions, frequently occurring in patients discharged from providers in surgical specialties. Encouraging providers to coordinate elective procedures during the index hospitalization may have prevented these unnecessary readmissions.

Over one quarter of avoidable readmissions may have been avoided through early outpatient follow-up. Early outpatient follow-up has already been shown to be effective in reducing 30-day readmissions for patients with heart failure.⁸ Similar benefits with early outpatient follow-up after hospitalization in patients with stroke and other cerebrovascular disease may also be seen. Given that our median time to readmission was 10 days, our study would suggest that follow-ups scheduled beyond 10 days may not prevent readmissions in half of our patients. While early outpatient follow-up could possibly identify unresolved issues from the hospitalization and lead

Table 2. Checklist of Items to Reduce Avoidable 30-Day Readmissions

Elective procedures should be coordinated during the index hospitalization or beyond 30 days of discharge.
Outpatient clinic appointments should be scheduled prior to discharging the patient, especially among patients who have no primary care physician; consider scheduling outpatient follow-up appointments within 10 days of discharge.
Diagnostic tests for stroke evaluation (eg, echocardiography) should be completed during the index hospitalization so that abnormalities are addressed during the same hospitalization.
Initiate discussions with patient and family members regarding options for palliative care and hospice early in patients who are eligible.
As part of discharge instructions, inform patients of symptoms that should prompt return to hospital versus symptoms which can be discussed at initial outpatient clinic follow-up.
Provide patients with an office contact number to discuss any concerns.

to potentially higher rates of readmission, data on early outpatient follow-up in congestive heart failure patients suggest that this approach results in reduced readmissions.⁸ Earlier follow-up after hospital admission for stroke may be one possible intervention to help reduce readmission in this population. While a risk-standardized model for predicting readmission risk after stroke could be used to stratify patients more likely to require early outpatient follow-up, a recent systematic review found inconsistent patient and system-level factors associated with readmission.⁹ The development of a suitable risk-standardized model to predict readmission will be a valuable tool to help identify other ways to prevent unnecessary readmission in these patients.

Delays in palliative care consultation were another significant contributor to avoidable readmissions. Palliative care supportive services have been shown to improve patient satisfaction and decrease hospital readmission rates as well as lower costs of care in patients with terminal illnesses.¹⁰ Efforts should be made to identify hospice-appropriate stroke patients who may benefit from palliative care services to clarify goals of care and facilitate transition to hospice care.

Our study was limited to a single university-based tertiary care hospital and results may not be generalizable to other settings. Due to the limited information on stroke severity and comorbid illnesses in UHC data, we were unable to adjust for these potential predictors of readmission. While our 30-day readmission rate was only 6.4%, we only captured readmissions to the index hospital which likely underestimated the true readmission rate for our patient population. Previously reported estimates for 30-day readmission rates in patients with stroke have varied from 6.5% to 24.3%, depending on the study methods used to ascertain readmissions.⁹ Another recent study reported risk-standardized readmission rates for patients with ischemic stroke, ranging from 9.2% to 19.2% for hospitals with Joint Commission-certified primary stroke centers and 8.8% to 18.4% for hospitals without primary stroke

centers.¹¹ However, it remains unclear whether Joint Commission certification directly leads to lower readmission rates or rather selects out hospitals with lower readmission rates even prior to Joint Commission certification. Finally, our analysis of avoidable readmissions was limited by a retrospective review of patient cases; whether the efforts we have described can reduce 30-day readmissions will need to be evaluated prospectively.

Authors' Note

Statistical analyses of this were performed by Steven Culler, PhD, associate professor, Department of Health Policy and Management, Rollins School of Public Health, Emory University. Dr Nahab received honoraria from Imedex and the National Stroke Association for educational activities and serves as a medicolegal consultant.

Declaration of Conflicting Interests

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