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Readmission within 1 month of discharge among patients with acute ischemic stroke: results of the University HealthSystem Consortium Stroke Benchmarking study

M. Fareed K. Suri, MD[1] and **Adnan I. Qureshi, MD**[1]
[1] *Zeenat Qureshi Stroke Research Center, University of Minnesota, Minneapolis, MN, USA*

Abstract

Background: The University HealthSystem Consortium (UHC) recently conducted a benchmarking project to identify variations in processes of care and clinical resource management, identify new patterns in practice, and distinguish opportunities for improvement among UHC hospitals.

Methods: We performed this analysis to determine the rate of and factors associated with readmission within 1 month of discharge among patients with acute ischemic stroke. A retrospective review of 40 consecutive ischemic stroke cases meeting inclusion criteria and discharge between January 1st and June 30th, 2004 was conducted in 32 hospitals. We performed a multivariate analysis to identify demographic and clinical factors associated with readmission among patients with ischemic stroke.

Results: A total of 1018 patients (mean age 66 years, range 18–98 years), who were discharged from the hospital and had follow-up available, were analyzed. A total of 90 (9%) of these patients were readmitted within 1 month of discharge. Common reasons for readmission were recurrent stroke (24%), infection (12%), chest pain or myocardial infarction (10%), worsening of stroke symptoms (7%), arrhythmias (7%), and congestive heart failure (3%). In univariate analysis, older patients (P = 0.03) and those discharged home without health care were more likely to be readmitted (P = 0.04). In the multivariate analysis, age was the only predictor for readmission. For each decade older age, there was a 19% increase in odds of readmission. Patient's race/ethnicity, presence of cardiovascular risk factors, and severity of stroke, insurance status, neurology consultation, discharge destination were not associated with readmission.

Conclusions: In the present multicenter study, 9% of the discharged patients with ischemic stroke were readmitted within a 1 month. Several etiologies for readmission were identified to assist in implementing quality improvement strategies.

Introduction

Economic burden from stroke hospitalization was about $21 million in 2010 in the United States [1]. A significant proportion (20–40%) of the patients admitted with stroke are readmitted within a year [2–4]. About 25% of all readmissions are within 1 month of initial event [2]. Readmission after discharge from any medical condition is an economic burden and is recently being realized as an important outcome measure for several medical conditions [5–7]. Currently, Medicare pays for any readmission after 24 h. Medicare currently spends about $12 billion on potentially preventable readmissions. Readmissions within 30 days is an area of special focus by Medicare Payment Advisory Commission (MEDPAC), as about 18% of all Medicare hospital admission are readmissions within 30 days. In an effort to reduce this cost, MEDPAC recommends holding providers financially accountable for service use around a hospital admission by reducing payment to hospitals with relatively high readmission rates for common conditions [8]. Currently, MEDPAC has identified acute myocardial infarction, heart failure, and pneumonia as common, costly, and often preventable readmissions. The 30-day hospital readmission measures for these medical conditions are now publicly reported by U.S. Department of Health and Human Services [9].

A significant proportion of acute readmissions are probably due to unaddressed medical issues at the time of discharge. Considering the high incidence of ischemic stroke in the United States, understanding the reason for readmission after stroke can have significant economic impact. There is limited data about the etiology of read-

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missions after acute stroke. Bravata *et al* reported the readmission etiology based on Medicare data and reported the Diagnosis Related Group (DRG) based diagnosis for readmission [2]. We report the 1 month readmission rate and the reason for readmission using a multicenter clinical chart review data.

Methods

Patient population

The University HealthSystem Consortium's (UHC's) Stroke 2005 Benchmarking Project gathered data from the charts of stroke patients treated in academic medical centers. The 2005 project involved 32 participating hospitals [10]. Data was collected by a retrospective chart review of 40 cases that met the inclusion criteria and were admitted and discharged between January 1, 2004 and June 30, 2004. Data collection was performed from October to December 2004.

Inclusion/exclusion criteria

The UHC project included all patients aged 18 or above with primary discharge diagnosis of ischemic stroke (ICD-9 codes 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91 or 436) and admitted from the emergency department. Patients transferred from emergency department to emergency department were included, but patients transferred from another acute care facility were excluded.

Data collection

All data were abstracted by clinical chart review and included demographic characteristics, medical history, clinical presentation, administration of thrombolytic, key medical management factors, in-hospital complications, discharge status, and outcome within 30 days.

Defnition of variables

For the current study, readmission within 30 days of the discharge was used as the outcome variable. Patients readmitted for elective carotid surgery (n = 9), other elective surgery (n = 4) or for acute rehabilitation (n = 7) were not considered as readmissions for this study.

Independent variables examined for association included age, sex, race (white/African-American/other), insurance status (insured/uninsured), history of vascular risk factors (diabetes mellitus, hypertension, hyperlipidemia, and cigarette smoking), Wake Forest Stroke Severity Scale [11], hours from symptom onset to arrival in hospital, administration of intravenous thrombolytic (yes/no), consultation by neurologist (yes/no), and discharge disposition. Discharge disposition was categorized as discharge to home without health services, discharge to home with health services, discharged to acute inpatient rehabilitation (hospital or non-hospital owned), discharge to skilled nursing facility (including hospital or non-hospital owned subacute inpatient rehabilitation facility), and other (including unknown and against medical advice).

Statistical analysis

We determined the association of independent variables with risk of readmission using t-test for continuous and chi-square for categorical variables. Association of readmission with the selected variables and variable identified by previous studies was then determined in multivariate analysis using forward stepwise logistic regression. All analyses were performed in SAS software v9.2 (SAS Institute Inc., Cary, NC, USA).

Results

Data were collected from a total of 1256 acute ischemic stroke patients from 32 hospitals. After excluding patients who died in-hospital (n = 66), died within 30 days of discharge (n = 9), or were lost to follow-up (n = 163), 1018 patients were included in this study. Mean age of the patients was 66.2 years (standard deviation [SD] = 14.3), 51% were male and 90(9%) of the patients were readmitted within 30 days of discharge.

Table 1 shows the comparison of clinical characteristics of patients based on readmission status. Readmitted patients were older (69 vs 65 years). Also, patients discharged home without health services were more likely to be readmitted compared to those discharged home with health services (P = 0.02) or to rehabilitation facility (P = 0.002). There was no difference in gender, race, insurance status, vascular risk factor status, neurology consultation, thrombolytics administration, time from symptoms onset to arrival and Wake Forest stroke scale between those readmitted and those not. There was also no association of in-hospital complications including pneumonia, urinary tract infection, myocardial infarction, venous thrombosis or intracranial hemorrhage between the two groups (Table 2).

In stepwise logistic regression model, increasing age remained significantly associated with increasing risk of readmission. There was 19% increase in odds of readmission for each decade increase in age. No association was identified for uninsured status (OR 0.8, 95% CI 0.3–1.9), neurology consultation during hospitalization (OR 1.3, 95% CI 0.9–2.1), and discharge to facilities other than home care (OR 1.0, 95% CI 0.6–1.6).

Table 1.
Clinical characteristics of patients readmitted or not within 30 days of discharge

		Not readmitted (n = 928)	Readmitted (n = 90)	P-value*
Age		65 ± 14	69 ± 13	0.03
Sex	Female	456 (49%)	44 (49%)	0.96
	Male	472 (51%)	46 (51%)	
Race	White	501(54%)	52 (58%)	0.55
	African-American	305 (33%)	28 (31%)	
	Other	122 (13%)	10 (11%)	
Insurance status	Insured	837 (90%)	84 (93%)	0.33
	Uninsured	91 (10%)	6 (7%)	
Smoking status	Current smoker	252 (27%)	21 (23%)	0.24
	Past smoker	188 (20%)	25 (28%)	
	Never	488 (52%)	44 (49%)	
History of hypertension	No	204 (22%)	26 (29%)	0.14
	Yes	724 (78%)	64 (71%)	
History of diabetes mellitus	No	594 (64%)	67 (74%)	0.05
	Yes	334 (36%)	23 (26%)	
History of hyperlipidemia	No	585 (63%)	55 (61%)	0.71
	Yes	343 (37%)	35 (39%)	
Wake Forest Scale	Mild stroke	434 (47%)	42 (47%)	0.93
	Moderate stroke	231 (25%)	25 (28%)	
	Severe stroke	132 (14%)	11 (12%)	
	Unknown	131 (14%)	12 (13%)	
Hours from symptom onset to arrival in emergency department	<1 h	79 (9%)	11 (12%)	0.54
	1–2 h	66 (7%)	4 (4%)	
	2–3 h	40 (4%)	4 (4%)	
	>3 h	743 (80%)	71 (79%)	
Previous history of stroke	No	618 (67%)	55 (61%)	0.29
	Yes	310 (33%)	35 (39%)	
Thrombolytics administered	No	854 (92%)	82 (91%)	0.76
	Yes	74 (8%)	8 (9%)	
Neurology consulted	No	379 (41%)	31 (34%)	0.23
	Yes	549 (59%)	59 (66%)	
Discharge disposition	Home without health services	417 (45%)	33 (37%)	Ref
	Home with health services	109 (12%)	18 (20%)	0.02
	Rehabilitation facility	186 (20%)	14 (16%)	0.002
	Short-term facility	160 (17%)	22 (24%)	0.06
	Other/unknown	56 (6%)	3 (3%)	0.5

*P-value calculated using student t-test for continuous variable or chi-square test for categorical variables. For variables with more than 2 categories, individual chi-square tests were performed using a reference category if overall chi-square P-value < 0.05.

Table 2.
In-hospital complications are rates of readmission within 30 days

	Not readmitted (n = 928)	Readmitted (n = 90)
Myocardial infarction	7 (0.7%)	2 (2.2%)
Pneumonia	35 (3.7%)	4 (4.4%)
Urinary tract infection	87 (9.4%)	10 (11.1%)
Seizure	31 (3.3%)	4 (4.4%)
Deep venous thrombosis or pulmonary embolism	4 (0.4%)	0
Confusion/depression/agitation	52 (5.6%)	7 (7.8%)
Intracranial bleeding (including hemorrhagic conversion)	19 (2.1%)	2 (2.2%)

Table 3 lists the reasons for readmission. Most common reason for readmission was recurrent stroke (24%). Other common reasons for readmission include infections (12%), coronary events (10%), worsening or persistence of stroke symptoms (7%), and arrhythmias (7%).

Discussion

In this multicenter study, we noted that 9% of the patients are readmitted for unexpected reasons within 1 month of discharge after acute stroke. The most common reason for readmission was recurrent stroke (24%). Readmission after acute stroke is considered clinically and economically an important issue [12]. Lichtman *et al* reviewed 7 studies that identified predictors of readmission within 30 days after stroke hospitalization [12]. Factors associated with readmission included insurance type, hospital proximity, first-ever stroke, length of stay, care requirement, discharge destination, physical functioning, previous hospitalizations, physician specialty, hospital characteristics, and discharge planning. Only physician specialty and insurance type were identified as predictors of readmission in more than one study. We used most of these variables in our regression model for prediction of readmission, but did not identify any of these factors as a predictor. Discharge destination

Table 3.
Etiology of readmission

Reason for readmission	Count (%)
Recurrent stroke	22 (24%)
Pneumonia and other infection	11 (12%)
Myocardial infarction and other chest pain	9 (10%)
Worsening or persistent stroke symptoms	6 (7%)
Arrhythmias	6 (7%)
Congestive heart failure	3 (3%)
Deep venous thrombosis or pulmonary embolism	3 (3%)
Dehydration	3 (3%)
Seizure	2 (2%)
Mental status change	2 (2%)
Anticoagulation issues	2 (2%)
Bleeding	2 (2%)
Fall	1 (1%)
Failed social situation or lack of support	0
Other reasons	16 (18%)

appeared significantly associated with risk of readmission in the univariate analysis. Patients who were discharged home without home health services were more likely to be readmitted than those discharged to home or other places with health services. Discharge destination was studied in two studies and was not found as a predictor for readmission [13,14]. The lack of consistency of predictors between studies and failure to replicate any of the previously noted predictors in our study is probably due to dissimilar definitions of variables. Also, whereas other studies have considered all cause admissions, we excluded admissions for elective surgeries and acute rehabilition. These admissions contributed about 20% of all readmissions in our database.

After stepwise regression, only increasing age was a predictor of readmission. This finding, although not identified by any previous studies, was not unexpected. Elderly patients are more likely to be at risk of the developing medical conditions that were the etiology of readmission in our study. In univariate analysis, there was lower risk of readmission in diabetics. This finding was probably because of confounding between diabetes status and age, as diabetic patients were younger (64 vs 67 years).

Readmission rate noted in our study was comparable to what has been reported using Medicare data (12–14%) or single center studies (10%) [2,15,16]. Chuang *et al* reported 1 month readmission rates of 24.3%, but the study included only patients who had reported functional limitations in any activity [17]. Bravata *et al* identified that the most common reasons for readmission within 30 days were pneumonia or respiratory illness (14%), stroke or transient ischemic attack (13%), and coronary events (6%). We noted that a significant proportion of readmissions (31%) is mainly because of either recurrent stroke or worsening of residual stroke symptoms. Methodology for identification of readmission etiology was quite different between two studies and may explain some differences in the proportion of readmission reasons. In the UHC dataset, readmission etiology was abstracted from clinical chart review, whereas in the Medicare dataset it was DRG based. Age group differences between two datasets can also partly explain the differences, as Medicare is limited to age 65 or older. Younger patients may have noted subtle new symptoms as compared to elderly. It is also noteworthy that we excluded admissions for any elective surgery or acute rehabilitation.

With growing realization of economic burden of readmission, it is important to understand etiology of this problem in stroke patients. Besides the admissions, due to recurrent stroke, most of the other etiologies are probably related to medical management during hospitalization and are potentially preventable. A high rate of pneumonia probably can benefit from better swallowing screen. Readmissions related to cardiac diseases are probably due to alteration of medications during the admission and can potentially benefit from careful review of medications at discharge.

Conclusion

The study has multiple limitations. About 14% of the patients were lost to follow-up. However, it is unlikely that those lost to follow-up were readmitted. The data were collected by clinical chart review and it is possible that the exact reason for admission may be inaccurately extracted. The study was limited to only university hospitals and the rate and reasons for readmission may be different for non-academic hospitals. In conclusion, this study highlights that most of the readmissions after acute stroke admission are due to potentially preventable reasons.

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