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Use of Dysphagia Screening Results in Predicting Poststroke Pneumonia

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Abstract

Background and Purpose—Dysphagia screening before oral intake (DS) is a stroke care quality indicator. The value of DS is unproven. Quality adherence and outcome data from the Paul Coverdell National Acute Stroke Registry were examined to establish value of DS.

Methods—Adherence to the DS quality indicator was examined in patients with stroke discharged from Paul Coverdell National Acute Stroke Registry hospitals between March 1 and December 31, 2009. Patients were classified as unscreened (US), screened and passed (S/P), and screened and failed. Associations between screening status and pneumonia rate were assessed by logistic regression models after adjustment for selected variables.

Results—A total of 18 017 patients with stroke discharged from 222 hospitals in 6 states were included. A total of 4509 (25%) were US; 8406 (47%) were S/P, and 5099 (28%) were screened and failed. Compared with US patients, screened patients were significantly more impaired. Pneumonia rates were: US 4.2%, S/P 2.0%, and screened and failed 6.8%. After adjustment for demographic and clinical features, US patients were at a higher risk of pneumonia (OR, 2.2; 95% CI, 1.7 to 2.7) compared with S/P patients.

Conclusions—Data suggest that patients are selectively screened based on stroke severity. Pneumonia rate was higher in US patients compared with S/P patients. Clinical judgment regarding who should be screened is imperfect. S/P patients have a lower pneumonia rate indicating that DS adds accuracy in predicting pneumonia risk. The Joint Commission recently retired DS as a performance indicator for Primary Stroke Center certification. These results suggest the need to implement a DS performance measure for patients with acute stroke.

Keywords

aspiration pneumonia; dysphagia screening; performance measure; quality of care

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Disclosures
None.

Dysphagia or impaired swallowing is common after stroke. The estimated incidence of poststroke dysphagia ranges between 29% and 78% depending on the anatomic location of the stroke and the diagnostic or screening test used to identify this condition.[1] Dysphagia increases the risk of aspirating food and oral secretions into the lungs and subsequent pneumonia. Poststroke pneumonia risk was 3-fold higher in patients with dysphagia compared with those without and 11-fold higher when dysphagia was severe enough to result in aspiration.[1] Pneumonia contributes to longer hospital stays, rehospitalizations, and is an important cause of poststroke mortality.[2]

Although there is no randomized controlled trial evidence that dysphagia screening in and of itself prevents pneumonia or improves outcomes in individual patients, studies have shown that hospitals using mandatory and formal dysphagia screening and management protocols had lower pneumonia rates than those without such protocols in place.[3,4]

The Paul Coverdell National Acute Stroke Registry is an ongoing stroke care quality improvement program funded by the Centers for Disease Control and Prevention. Care quality in this and other nationwide stroke programs (The Joint Commission Primary Stroke Center Certification program and Get-With-The-Guidelines–Stroke program) is measured by a set of harmonized performance measures.[5] One of these measures, dysphagia screening before oral intake (DS), is defined as: “Percentage of ischemic and hemorrhagic stroke patients who undergo a screen for dysphagia using a simple, valid bedside testing protocol before receiving any food, fluids or medication by mouth.”

In our experience with the Paul Coverdell National Acute Stroke Registry, we found that although the overall care quality was high, DS compliance rates were low, ranging from 56% to 63% in Year 2008. One goal of the study described here was to assist hospitals by identifying patient subpopulations that were not getting screened and to determine the use of DS in identifying patients at risk of developing poststroke pneumonia. Another goal for our study was to examine the use of the DS measure in light of The Joint Commission decision to retire DS as a performance measure.

Data and Methods

The Paul Coverdell National Acute Stroke Registry provides feedback to states on adherence to guidelines of care to improve quality of care for hospitalized patients with stroke and transient ischemic attack in hospitals across 6 states (Georgia, Massachusetts, Michigan, Minnesota, North Carolina, and Ohio).[6] Hospital participation is voluntary. Trained abstractors from participating hospitals collect detailed information on stroke and transient ischemic attack admissions concurrent with or soon after patient care using standard data definitions provided by the Centers for Disease Control and Prevention.[6,7]

The main outcome for this study, pneumonia, was defined as nosocomial, hospital-acquired pneumonia occurring during hospitalization, at least ≥48 hours after admission, documented by a physician, and requiring antibiotic treatment. The main explanatory variable, swallow screening, and results of the screening had to be documented by a healthcare professional in the medical record before oral intake of food, fluid, or medications. If there was no documentation as to the performance of a swallow screen being done or the results of the screen were not documented, then abstractors were to assume it was not done or results were missing, respectively. If the swallow screen was contraindicated, then the contraindication must be documented in the medical record. Patients in whom a swallow screen was contraindicated were not included in this analysis. A screening test was not necessarily a formal evaluation of swallowing by a speech and language pathologist but had to be a standardized method of swallowing assessment accepted by the institution. Acceptable

methods of dysphagia screening included the following: bedside swallow assessment, simple water swallow test, Burke water swallow test, simple standardized bedside swallowing assessment, barium swallow, video fluoroscopy, double-contrast esophagoscopy, radionucleotide studies, manometry, endoscopy, and formal evaluation by a speech–language pathologist. Documentation of the National Institutes of Health Stroke Scale (NIHSS), testing of cranial nerves, or checking the gag reflex were not considered to be swallow screens.

Included in our analyses were patients with ischemic and hemorrhagic stroke aged ≥18 years discharged between March 1 and December 31, 2009. Excluded were patients who remained nothing by mouth throughout the hospital stay and also patients who had a documented reason for not undergoing DS (eg, intubation). We also excluded 6452 patients whose length of stay was ≤2 days reasoning that it usually takes at least 3 days for the development and detection of pneumonia as well as 5 patients with length of stay >120 days.

Statistical Analyses

Patient characteristics and outcomes were compared according to patient DS status (passed screening, failed screening and unscreened). The χ^2 was used for categorical variables and the Wilcoxon-Mann-Whitney rank test for continuous variables.

Logistic regression was used to assess the association between the outcome variable of interest, pneumonia during hospitalization, and DS status after adjusting for age, sex, race, and presence of clinical features (aphasia, weakness, altered level of consciousness). Stroke severity indices, the NIHSS for patients with ischemic stroke and Glasgow Coma Scale (GCS) for patients with hemorrhagic stroke, were missing in a large fraction of patients. Hence, clinical features, collinear with the severity indices, were used as surrogates of severity in the models. The adjusted OR were obtained along with 95% CIs. All statistical analyses were performed at the Centers for Disease Control and Prevention using SAS 9.2 (Cary, NC).

Results

A total of 18 017 observations were included in the study. Table 1 compares demographic and baseline characteristics across DS status. Patients who failed screening were older (median age, 74 years versus 70 years [passed] and 72 years [unscreened]) and had longer hospital stays (median, 6 days versus 5 days) compared with those who passed screening or were unscreened. The NIHSS was missing in 56% of patients with ischemic stroke and the GCS was missing in 19% of patients with hemorrhagic stroke precluding comparisons. There were no differences in the percent unscreened by race (P=0.53).

Tables 2 and 3 compare clinical characteristics, severity indices, surrogate markers of severity, and outcomes of screened versus unscreened patients (Table 2) and screened/passed versus screened/failed versus unscreened patients (Table 3). Patients who were screened were more likely to have weakness or aphasia compared with those who were not screened (Table 2). This differential impairment was also seen when severity indices were compared. Pneumonia rates in unscreened patients were lower than in those who failed screening (Table 3; 4.2% versus 6.8%) but were higher than in those who passed screening (2.0%). In the multivariate adjusted analysis (Table 4), unscreened patients were at a higher risk of pneumonia (OR, 2.2; 95% CI, 1.7 to 2.7) compared with those who passed screening. Similarly, those who failed screenings were also at a higher risk of pneumonia (OR, 3.6; 95% CI, 3.0 to 4.3) when compared with those who passed screening. Race was not associated with a higher risk of pneumonia (Table 4; P=0.32).

The outcome variable pneumonia itself was associated with a worse prognosis. Of those diagnosed with pneumonia, 10.1% died in the hospital compared with 2.1% of those not so diagnosed ($P<0.0001$). Median length of stay was 13 days (range, 3 to 118 days) in those diagnosed with pneumonia compared with 5 days (range, 3 to 99 days) in those without pneumonia ($P<0.0001$).

Discussion

The association between DS and occurrence of aspiration pneumonia has not been examined by a randomized controlled trial likely due to ethical standards that would preclude randomizing patients with stroke to nonscreening. Hence, we rely on observational data to demonstrate the use of DS. Prior studies and our data (Table 2) show the counterintuitive result of higher pneumonia risk in patients who underwent DS compared with those unscreened.[3] That is not surprising. The widely accepted explanation (also supported by our data) is that those who were likely to be screened were more overtly impaired than those unscreened. Hence, patients are selectively screened based on stroke severity. The higher pneumonia rate in unscreened patients compared with those who passed screening indicates that physicians' clinical judgment on who to screen is imperfect. This is consistent with Hinchey et al's[3] conclusions that universal screening of all patients with stroke reduces overall pneumonia rates.

Prior studies lacked data on the results of DS (ie, passed or failed screening); hence, the use of DS could not be demonstrated. Our study shows that patients who failed screening have a higher risk of pneumonia than those who passed screening, thereby demonstrating that DS results add accuracy in predicting pneumonia risk. Increased vigilance in those who fail screening can help early identification and treatment of pneumonia.

Nationwide stroke programs such as the Paul Coverdell National Acute Stroke Registry and Get-With-The-Guidelines–Stroke monitor rates of DS in hospitalized patients with stroke as a performance measure indicating care quality. As stated earlier, The Joint Commission Primary Stroke Center certification included DS as a performance measure until 2009. When DS was not endorsed by the National Quality Forum, The Joint Commission retired it as a performance measure in 2010. It is our understanding that this measure was not endorsed by the National Quality Forum primarily because no systematically defined standard exists for what constitutes a valid dysphagia screening tool nor has a single swallow screen been identified through controlled clinical trials as being superior. We have shown that unscreened individuals are at a higher risk of pneumonia than are patients who are screened and pass, even though a variety of hospital-specific tools are likely being used for screening by the Paul Coverdell National Acute Stroke Registry hospitals.

The lack of National Quality Forum-endorsed DS performance measures in the stroke measure set for The Joint Commission may reduce overall screening rates, which could increase poststroke complication rates. Given our results, a new stroke measure for DS/pneumonia prevention should be developed for acute stroke care.

Strengths of our study include the large sample size and the availability of patient clinical features enabling adjustment for stroke severity, an important confounder and determinant of poststroke pneumonia. We acknowledge that our study ascertains only in-hospital pneumonia outcomes; postdischarge pneumonia and consequent rehospitalization could be part of the picture as well and this is not captured by our data. A different question we are unable to address with our data is whether and how the results of the DS were acted on, that is, were the patients who failed the DS given modified diets or other behavioral interventions such as coaching on safe swallowing techniques? Counterfactually, would

pneumonia rates have been higher among those who had failed screening if they were unscreened? The impact of interventions for poststroke dysphagia on patient outcomes has been understudied.[8] One single-center, single-blind randomized controlled study by Carnaby et al[9] demonstrated that behavioral interventions for dysphagia were associated with significantly lower rates of chest infections, although this outcome was a secondary end point. More trials to identify appropriate interventions to improve the outcomes of patients with poststroke dysphagia are needed and, when available, will further reinforce the use of DS as a measure of stroke care quality.

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Table 1

Baseline Characteristics by Dysphagia Screening

	N (%) or Statistics by Dysphagia Screening				
Variables	**Overall n (%) or Statistics (n=18017)***	**Pass (n=8406)**	**Fail (n=5099)**	**Unscreened (n=4509)**	***P*-Value**
Age at admission					
Median	71	70	74	72	
[Range]	[18–103]	[18–101]	[19–103]	[18–103]	
Mean (SE)	69.6 (0.1)	68.7 (0.2)	71.1 (0.2)	69.5 (0.2)	<0.0001
Length of stay					
Median	5	5	6	5	
[Range]	[3–118]	[3–99]	[3–106]	[3–118]	
Mean (SE)	6.79 (0.04)	6.24 (0.06)	8.03 (0.10)	6.41 (0.08)	<0.0001
Gender (1 missing)					
Male	8625 (47.9)	4129 (49.1)	2360 (46.3)	2135 (47.3)	
Female	9391 (52.1)	4276 (50.9)	2739 (53.7)	2374 (52.7)	0.004
Ethnicity					
Hispanic or Latino	345 (1.9)	161 (1.9)	91 (1.8)	93 (2.1)	
Others	17672 (98.1)	8245 (98.1)	5008 (98.2)	4416 (97.9)	0.61
Race					
White	12963 (71.9)	5875 (69.9)	3857 (75.6)	3230 (71.6)	
Black/African American	3996 (22.2)	2063 (24.5)	931 (18.3)	1000 (22.2)	
Asian	260 (1.4)	93 (1.1)	92 (1.8)	75 (1.7)	
Others	798 (4.4)	375 (4.5)	219 (4.3)	204 (4.5)	<0.0001
Final diagnosis					
Ischemic	15076 (83.7)	7131 (84.8)	4168 (81.7)	3774 (83.7)	
Intracerebral hemorrhage	2084 (11.6)	910 (10.8)	677 (13.3)	497 (11.0)	
Subarachnoid hemorrhage	857 (4.8)	365 (4.3)	254 (5.0)	238 (5.3)	<0.0001

*Three patients were missing data on dysphagia screening status.

Table 2

Patient Clinical Features, Measures of Stroke Severity Including Surrogate Measures of Severity and Outcomes by Dysphagia Screening Status (Screened vs Unscreened)

Variables	N (%) by Dysphagia Screening			*P*-Value
	Overall n (%) (n=18017)*	Screened (n=13505)*	Unscreened (n=4509)*	
Clinical Variables				
Weakness				
Yes	9871 (54.8)	7849 (58.1)	2022 (44.8)	
No/ND	8146 (45.2)	5656 (41.9)	2487 (55.2)	<0.0001
Altered level of consciousness				
Yes	2823 (15.7)	2138 (15.8)	685 (15.2)	
No/ND	15194 (84.3)	11367 (84.2)	3824 (84.8)	0.32
Aphasia				
Yes	3638 (20.2)	3046 (22.6)	592 (13.1)	
No/ND	14379 (79.8)	10459 (77.4)	3917 (86.9)	<0.0001
Stroke Severity Indices				
NIHSS (Total Ischemic N=15076)				
Ischemic: NIHSS≥10	1803 (12.0)	1630 (14.4)	173 (4.6)	
Ischemic: NIHSS<10	4884 (32.4)	3896 (34.5)	988 (26.2)	
Ischemic: NIHSS missing	8389 (55.6)	5773 (51.1)	2613 (69.2)	<0.0001
GCS (Total Hemorrhagic N=2941)				
Hemorrhagic: GCS<9	226 (7.7)	173 (7.8)	53 (7.2)	
Hemorrhagic: GCS 9–12	274 (9.3)	221 (10.0)	53 (7.2)	
Hemorrhagic: GCS≥13	1882 (64.0)	1394 (63.2)	488 (66.4)	
Hemorrhagic: GCS score missing	559 (19.0)	418 (19.0)	141 (19.2)	0.12
Surrogate Measures of Severity				
Independent ambulation at day 2				
Yes	6401 (35.5)	4409 (32.6)	1992 (44.2)	
No/ND	11616 (64.5)	9096 (67.4)	2517 (55.8)	<0.0001
Independent ambulation at discharge				
Yes	7159 (39.7)	5259 (38.9)	1899 (42.1)	
Other	10858 (60.3)	8246 (61.1)	2610 (57.9)	0.0002
Discharge to self care				
Self care	5276 (29.3)	3841 (28.4)	1435 (31.8)	
Other	12741 (70.7)	9664 (71.6)	3074 (68.2)	<0.0001
Death				
Death	437 (2.4)	311 (2.3)	126 (2.8)	
Alive	17580 (97.6)	13194 (97.7)	4383 (97.2)	0.07
Outcome of Interest				
Pneumonia				
No	17306 (96.1)	12985 (96.1)	4318 (95.8)	
Yes	711 (3.9)	520 (3.9)	191 (4.2)	0.25

*N indicated applies to all variables except NIHSS and GCS which have a different N as indicated next to those variables.

NIHSS=National Institutes of Health Stroke Scale. GCS=Glasgow Coma Scale.

Three patients were missing data on dysphagia screening status.

Table 3

Clinical Variables, Measures of Severity Including Surrogate Measures of Severity and Outcomes by Dysphagia Screening Status and Results (Screened/Passed vs Screened/Failed vs Unscreened)

		N (%) by Dysphagia Screening Status and Results			
Variables	**Overall n (%) (n=18017)***	**Screen/Pass (n=8406)***	**Screen/Fail (n=5099)***	**Unscreened (n=4509)***	***P*-Value**
Clinical Variables					
Weakness					
Yes	9871 (54.8)	5474 (65.1)	2375 (46.6)	2022 (44.8)	
No/ND	8146 (45.2)	2932 (34.9)	2724 (53.4)	2487 (55.2)	<0.0001
Altered level of consciousness					
Yes	2823 (15.7)	1307 (15.5)	831 (16.3)	685 (15.2)	
No/ND	15194 (84.3)	7099 (84.5)	4268 (83.7)	3824 (84.8)	0.30
Aphasia					
Yes	3638 (20.2)	1849 (22.0)	1197 (23.5)	592 (13.1)	
No/ND	14379 (79.8)	6557 (78.0)	3902 (76.5)	3917 (86.9)	<0.0001
Stroke Severity Indices					
NIHSS (Total Ischemic N=15076)					
Ischemic: NIHSS≥10	1803 (12.0)	637 (8.9)	993 (23.8)	173 (4.6)	
Ischemic: NIHSS<10	4884 (32.4)	2825 (39.6)	1071 (25.7)	988 (26.2)	
Ischemic: NIHSS missing	8389 (55.6)	3669 (51.5)	2104 (50.5)	2613 (69.2)	<0.0001
GCS (Total Hemorrhagic N=2941)					
Hemorrhagic: GCS<9	226 (7.7)	57 (4.5)	116 (12.5)	53 (7.2)	
Hemorrhagic: GCS 9–12	274 (9.3)	86 (6.7)	135 (14.5)	53 (7.2)	
Hemorrhagic: GCS≥13	1882 (64.0)	885 (69.4)	509 (54.7)	488 (66.4)	
Hemorrhagic: GCS score missing	559 (19.0)	247 (19.4)	171 (18.4)	141 (19.2)	<0.0001
Surrogate Measures of Severity					
Independent ambulation at day 2					
Yes	6401 (35.5)	3176 (37.8)	1233 (24.2)	1992 (44.2)	
No/ND	11616 (64.5)	5230 (62.2)	3866 (75.8)	2517 (55.8)	<0.0001
Independent ambulation at discharge					
Yes	7159 (39.7)	3884 (46.2)	1375 (27.0)	1899 (42.1)	

Variables	Overall n (%) (n=18017)*	N (%) by Dysphagia Screening Status and Results			*P*-Value
		Screen/Pass (n=8406)*	Screen/Fail (n=5099)*	Unscreened (n=4509)*	
Other	10858 (60.3)	4522 (53.8)	3724 (73.0)	2610 (57.9)	<0.0001
Discharge to self care					
Self care	5276 (29.3)	2862 (34.0)	979 (19.2)	1435 (31.8)	
Other	12741 (70.7)	5544 (66.0)	4120 (80.8)	3074 (68.2)	<0.0001
Death					
Death	437 (2.4)	105 (1.2)	206 (4.0)	126 (2.8)	
Alive	17580 (97.6)	8301 (98.8)	4893 (96.0)	4383 (97.2)	<0.0001
Outcome of Interest					
Pneumonia					
No	17306 (96.1)	8234 (98.0)	4751 (93.2)	4318 (95.8)	
Yes	711 (3.9)	172 (2.0)	348 (6.8)	191 (4.2)	<0.0001

*N indicated applies to all variables except NIHSS and GCS which have a different N as indicated next to those variables.

NIHSS=National Institutes of Health Stroke Scale. GCS=Glasgow Coma Scale.

Three patients were missing data on dysphagia screening status.

Table 4

Results of Multiple Logistic Regression Analyses: Pneumonia Outcome and Dysphagia Screening Status

Characteristics	Adjusted Odds Ratio (95% CI)	*P*-Value
Age as continuous	0.994 (0.989, 0.999)	0.02
Gender		
Male	1.23 (1.06, 1.43)	
Female	Reference	0.008
Race		
White	Reference	
Black	0.84 (0.69, 1.03)	
Asian	1.15 (0.65, 2.03)	
Other	1.05 (0.74, 1.51)	0.32
Dysphagia screening and results		
Pass	Reference	
Fail/Not documented	3.59 (2.97, 4.34)	
No screening	2.15 (1.74, 2.66)	<0.0001
Weakness		
No	Reference	
Yes	1.08 (0.92, 1.26)	0.37
Altered level of consciousness		
No	Reference	
Yes	1.96 (1.64, 2.34)	<0.0001
Aphasia		
No	Reference	
Yes	0.89 (0.73, 1.08)	0.24

The model examines pneumonia as an outcome vs the main explanatory variable of dysphagia screening status, adjusting for age, gender, race, weakness and altered level of consciousness.