Prospective Quality Initiative to Maximize Dysphagia Screening Reduces Hospital-Acquired Pneumonia Prevalence in Patients With Stroke

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Background and Purpose—Dysphagia can lead to pneumonia and subsequent death after acute stroke. However, no prospective study has demonstrated reduced pneumonia prevalence after implementation of a dysphagia screen.

Methods—We performed a single-center prospective interrupted time series trial of a quality initiative to improve dysphagia screening. Subjects included all patients with ischemic or hemorrhagic stroke admitted to our institution over 42 months with a 31-month (n=1686) preintervention and an 11-month (n=648) postintervention period. The intervention consisted of a dysphagia protocol with a nurse-administered bedside dysphagia screen and a reflexive rapid clinical swallow evaluation by a speech pathologist.

Results—The dysphagia initiative increased the percentage of patients with stroke screened from 39.3% to 74.2% ($P<0.001$). Furthermore, this initiative coincided with a drop in hospital-acquired pneumonia from 6.5% to 2.8% among patients with stroke ($P<0.001$). Patients admitted postinitiative had 57% lower odds of pneumonia, after controlling for multiple confounds (odds ratio=0.43; confidence interval, 0.255–0.711; $P=0.0011$). The best predictors of pneumonia were stroke type ($P<0.0001$), oral intake status ($P<0.0001$), dysphagia screening status ($P=0.0037$), and hospitalization before the beginning of the quality improvement initiative ($P=0.0449$).

Conclusions—A quality improvement initiative using a nurse-administered bedside screen with rapid bedside swallow evaluation by a speech pathologist improves screening compliance and correlates with decreased prevalence of pneumonia among patients with stroke. (***Stroke***. 2013;44:3154-3160.)

Key Words: cerebral hemorrhage ■ dysphagia ■ ischemic stroke ■ pneumonia ■ quality initiative ■ screening ■ subarachnoid hemorrhage

Dysphagia is present in 42% to 67% of patients within the first 3 days of stroke.[1] Dysphagia is also an independent predictor of poor outcome, prolonged recovery, and lengthened hospital stay after stroke.[2,3] Patients with stroke and dysphagia remain as inpatients 2 days longer, are half as likely to be discharged home, and twice as likely to be discharged to a nursing home.[4]

Pneumonia develops in nearly 21% of patients with stroke admitted to neurointensive care units during their hospitalization.[5] Furthermore, the risk of death increases 3-fold among those diagnosed with stroke and pneumonia.[6] The strongest risk factor for pneumonia among patients in acute rehabilitation is severe dysphagia (odds ratio [OR]=15.0; 95% confidence interval [CI], 2.3–631).[7] Patients with stroke-associated pneumonia show higher mortality rates than controls (35.3% versus 14.3%) and significantly poorer long-term clinical outcome (Rankin Scale, 3.5±1.7 versus 2.2±1.6).[5] Furthermore,

the cost of hospital-acquired pneumonia (HAP) is substantial, at 13 000 to 16 000 USD per event.[8] Although the cause of aspiration pneumonia is multifaceted, including dependent feeding, dependent oral care, teeth decay, and the presence of tube feeding,[9] dysphagia is an important risk for aspiration pneumonia. Furthermore, the high association among dysphagia, aspiration,[9] and HAP has led to the use of dysphagia screening as an important step in decreasing morbidity and mortality.

Hinchey et al[10] in a nonrandomized cross-sectional study examined pneumonia rates in 15 institutions and found that pneumonia rates at hospitals with a pre-existing dysphagia screening protocol were 2.4% versus 5.4% at sites with no formal screen. In a separate study of patients who had transient ischemic attack, swallowing evaluation (OR=0.64; 95% CI, 0.43–0.94) was 1 of only 3 care processes associated with improved outcomes.[11] In 2 retrospective observational studies,

implementation of a dysphagia screening program seemed to reduce the incidence of pneumonia.[4]

It has been previously shown that multimodal multidisciplinary formalized protocols can improve morbidity after stroke.[12] Although several well-validated bedside assessments exist,[4,13–19] no prospective study has demonstrated altered pneumonia rates after implementation of a dysphagia screen. In response to low-screening compliance at our institution, a formal dysphagia screening protocol was developed, which incorporated a bedside nursing dysphagia screen and reflexive rapid swallow evaluation by a speech pathologist. Screening compliance and pneumonia prevalence were tracked to determine if this intervention affected patient outcomes.

Methods

Our institution is an 852-bed, tertiary care center with a Joint Commission designated Primary Stroke Center. Before this intervention, all patients admitted with a suspected diagnosis of stroke were supposed to be screened by either a physician in the Department of Neurology using the Mann Assessment of Swallowing Ability (MASA)[20] or a speech pathologist performing a bedside swallow evaluation before receiving oral intake.

This process resulted in very poor assessment rates, low patient satisfaction, and long delays for any oral nutrition or medications. Therefore, an interdisciplinary team composed of neurosurgeons, vascular neurologists, nurses, social workers, speech pathologist, and pharmacists was formed. An institutional review identified multiple barriers. First, in our center a large number of hemorrhagic strokes were admitted directly to the Department of Neurosurgery. Because neurologists did not evaluate these patients in many cases, a MASA was not performed. Second, long delays were encountered before a speech pathologist performed bedside or clinical swallowing examination. This resulted in patients remaining nothing per mouth (nil per os; NPO) for >24 hours. Third, either because of lack of protocol compliance or in response to long wait times for speech pathology evaluations, many patients received oral intake before dysphagia evaluation.

In January 2008, other academic centers were consulted and a systematic literature search was performed to determine best practices. It was hypothesized that a 2-tiered dysphagia screen followed by a formal bedside swallow evaluation by a speech pathologist could ameliorate some of the aforementioned barriers. Although no trial has compared physician- and nursing-administered bedside screens, we felt that a nurse-administered screen had the greatest chance of success in our institution. Although an optimal dysphagia screen includes an oral challenge,[18,21] in our institution we encountered strong resistance from both the emergency department physicians and nursing staff concerning this component. They felt that an oral challenge would require (1) more training and (2) liquids that were not always available in the emergency department and (3) also that faculty were concerned that administration of an oral challenge by those other than a trained speech pathologist could result in increased aspirations. Therefore, the Emergency Department dysphagia screen developed by Anderson et al[22] was modified by eliminating the oral challenge to create our Modified Nursing Dysphagia Screen (MNDS), which was inexpensive, quick, and did not require juices or puddings (Table 1).

Table 1.   Modified Nursing Dysphagia Screen

Is the patient somnolent (not awake and alert)?

Is the patient wet with gurgly voice on speech or breathing?

Does the patient have dysarthria (slurred speech)?

Is the patient coughing or choking while breathing or talking?

Does the patient have difficulty with oral secretions requiring suctioning?

Does the patient/family report patient is unable to swallow or has difficulty with swallowing in the past?

Modifications were made in partnership with the Department of Speech, Language, and Hearing Sciences.

Intervention

In August 2010, the initiative consisting of 4 components was implemented. First, staff was educated on the initiative protocols. Second, the preprinted stroke order set was modified to include nothing per mouth including medications as the only diet order. Third, the MNDS was implemented. Finally, speech pathology swallow evaluations were expedited by allowing nurses to initiate consults directly once a patient had failed the MNDS. A Plan Do Study Act quality improvement approach was used to guide protocol modifications.[23]

After the implementation of the Dysphagia protocol, it began with all patients being given nothing per mouth including medications until screened. Next, nurses administered the MNDS. A screen failure was a defined as a positive response to any of the MNDS questions. On failure, the patient remained strictly NPO and a speech pathology consult was automatically generated by nursing staff and completed within 24 hours. If the patient passed the MNDS, they were allowed oral nutrition and medications.

Patients and Design

To evaluate the effectiveness of the dysphagia screening initiative, we performed a single-center prospective interrupted time series trial. Subjects included all patients admitted to our institution with a primary discharge diagnosis of stroke. Stroke was defined as discharge or death with an *International Classification of Diseases, Ninth Revision* code of 430, 431, 433.01, 433.10, 433.11, 433.21, 433.81, 433.91, 434.00, 434.01, 434.11, 434.91, 435, or 436. This included all stroke subtypes; ischemic stroke (and transient ischemic attacks), intracerebral hemorrhage, as well as nontraumatic subarachnoid hemorrhages (SAHs). Exclusion criteria were symptom resolution by arrival, failure to obtain a level of consciousness allowing for assessment of dysphagia during hospitalization (ie, the patient who remained intubated), or age <18. The study period consisted of a preintervention surveillance period (January 1, 2008, through July 31, 2010) followed by a postintervention phase (August 1, 2010, through June 31, 2011). Institutional review board approval was obtained (Protocol #7330-2120).

Outcome Measures

A project nurse or stroke program coordinator collected data with 95% inter-rater reliability calculated on every 10th chart. Data from our center were input and then captured from the Get With The Guidelines (GWTG)-Stroke program, a nationwide voluntary quality improvement program where >1000 acute care hospitals submit data on quality of care for stroke. The primary outcome measure was the proportion of patients with pneumonia, and the secondary outcome was discharge status. If pneumonia was mentioned in the discharge summary, radiographic interpretations, on daily clinical notes, or clinically appropriate antibiotics were given. Then, the Centers for Disease Control and National Health Safety Network criteria for clinically defined pneumonia (PNU1) were used for HAP.[24] In brief, the subject had to have ≥2 serial radiographs with 1 of the following: a new infiltrate, consolidation, or cavitation. Second, the patient had to have 1 of the following: fever >38°C, leukopenia or leukocytosis, or altered mental status. Finally, they had to have 2 of the following: new onset of purulent sputum, new onset of worsening cough, dyspnea, or tachypnea, rales or bronchial breath sounds, or worsening gas exchange by oxygen saturation or arterial blood gas. Ventilator-associated pneumonia was included in the above total but not recorded separately. Discharge disposition was recorded from each discharge summary and was trichotomized into poor outcome (death or hospice), intermediate outcome (transfer to another hospital or skilled nursing facility), or favorable outcome (rehabilitation hospital, home with or without home healthcare). To compare our screening rates with a national benchmark, we accessed data from the GWTG-Stroke program. Approval was obtained from GWTG for database usage and publication.

Education

Physician education was performed by a trained speech pathologist in the Department of Speech, Language, and Hearing Sciences through grand rounds lectures on neurology and neurosurgery every 6 months. Furthermore, a study-descriptive e-mail was sent to all staff physicians. Little resistance was encountered for this initiative from physicians because the burden of work was being shifted from physicians to nursing staff. For nurses, the initiative was disseminated through Quality teams, and an online mandatory Just in Time training PowerPoint was developed, and a post-test was used to assess knowledge. All nurses completed the training and achieved an acceptable post-test score of 80%.

Statistical Analysis

The relationship between quarterly dysphagia screening percentage and pneumonia prevalence was assessed by Pearson product moment correlation. A logistic regression model (SAS version 9.3) was created with pneumonia as the outcome. Treatment group was our primary predictor, and we included age, sex, race, and stroke subtype (SAH, intracranial hemorrhage, and ischemic stroke) as covariates. Hosmer–Lemeshow test assessed model fit. Three analyses were run: the first considered patients before the initiative as untreated; the second analysis used screened status (MNDS, MASA, or speech pathology clinical evaluation) versus unscreened regardless of timing; and the third analysis was performed only on postinitiative patients that were screened by the MNDS versus all other postinitiative patients. NPO status was collinear with treatment group membership. A P value <0.05 was considered significant. A stepwise elimination routine was used to determine best predictors of pneumonia. A $P \leq 0.3$ was the criterion for entry into the model and the criterion for staying in the model. Candidate factors were treatment group, age, sex, race, diagnosis, NPO status, screening status, admitting unit, and MNDS administration.

Results

Implementation of the Screening Initiative Increased Dysphagia Screening

In January 2008, using the GWTG database,[25,26] we noted that the percentages of patients with stroke screened for dysphagia nationally in all hospitals were 67.7% and 70.1% in academic centers. However, concurrently only 20% of patients with stroke at our institution were screened before oral intake (Figure 1, first time point). During the next 31 months, before our intervention, the prevalence of patients who received either a MASA[20] or a speech pathologist performing a bedside swallow evaluation was recorded and revealed that patients suffering from nontraumatic SAHs had the lowest prevalence of dysphagia evaluation (26.2%) followed by transient ischemic attacks (36.6%), intracerebral hemorrhages (40.8%), and ischemic strokes (49.4%; Figure 2, preintervention).

Thus, an interdepartmental quality improvement initiative to promote dysphagia screening was begun. The study population consisted of all patients with ischemic or hemorrhagic stroke admitted to our institution during a 42-month period with a 31-month (n=1686) preintervention period and an 11-month (n=648) postintervention period beginning in August of 2010. Comparison of the preintervention and postintervention groups showed no difference in sex (P=0.113), age (P=0.77), race (P=0.078), final stroke diagnosis (P=0.103), or National Institutes of Health Stroke Scale (NIHSS; P=0.885; Table 2).

After implementation of the initiative in August 2010, the average percentage of patients with stroke screened
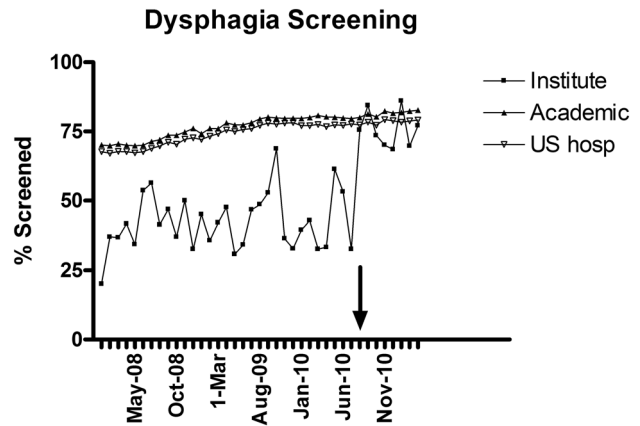

Figure 1. Prevalence of dysphagia screening among patients with stroke in our institution, all other academic hospitals, and all US hospitals who participate in Get With The Guidelines. Note that implementation of the Dysphagia screening initiative and the Modified Nursing Dysphagia Screen (arrow) brought our institution to the national standard within a month.

monthly rose from 39.3%±12.3 to 74.2%±15.1 postinitiative, an increase of 88.8% (Table 2; P<0.001; Figure 1, arrow indicates start of the initiative). Before this initiative, our hospital had significantly lower dysphagia screening prevalence when compared with all other hospitals in the GWTG database but was indistinguishable after intervention (F[2,124]=23.4; P<0.001; Figure 1). A significant increase over time was also noted, confirming the effectiveness and durability of the multidisciplinary dysphagia screening initiative (F[1,124]=71.44; P<0.001).

A patient was screened if either the MNDS or any other dysphagia evaluation was performed (MASA, Modified-MASA, or speech pathology bedside evaluation alone) before oral intake or medication. The majority of increased screening postinitiative was by the MNDS with 60% of patients with stroke receiving the MNDS screen (Table 2). After intervention, the monthly average MNDS screening percentage varied from 44.6% at the beginning of the initiative to a high of 72%. Of the 429 patients
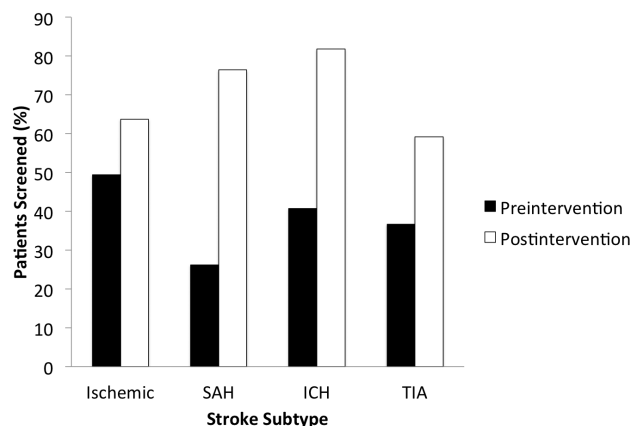

Figure 2. Prevalence of dysphagia screening by stroke type in our institution preintervention and postintervention. The percentage of patients screened by any method increased after intervention in all stroke types with the greatest increase among patients with nontraumatic subarachnoid hemorrhage. SAH indicates nontraumatic subarachnoid hemorrhage; ICH, intracerebral hemorrhage; and TIA, and transient ischemic attack.

Table 2.   Comparison of Patients Preintervention and Postintervention

	Preintervention	Postintervention	P Value
Time	January 2008 to July 2010	August 2010 to June 2011	
No. of patients	1686	648	
Sex			0.113
Men	787 (46.7%)	296 (45.7%)	
Women	899 (53.3%)	352 (54.3%)	
Age	63.8±15.4	63.6±16.1	0.777
Race			0.078
White	1201 (71.3%)	473 (73.0%)	
Black	367 (21.8%)	136 (21.0%)	
Hispanic	59 (3.5%)	30 (4.6%)	
Asian	18 (1.1%)	4 (0.6%)	
Indian	20 (1.2%)	1 (0.2%)	
Other	20 (1.2%)	4 (0.6%)	
Final diagnosis			0.103
Ischemic	785 (47.0%)	321 (49.6%)	
SAH	431 (25.8%)	135 (20.9%)	
ICH	293 (17.5%)	124 (19.2%)	
TIA	163 (9.8%)	67 (10.4%)	
NIHSS	8.8±7.0, n=354	8.5±6.3, n=86	0.885
Mild (0–8)	177 (52.8%)	48 (59.3%)	
Moderate (9–16)	100 (29.9%)	22 (27.1%)	
Severe (>16)	58 (17.3%)	11 (13.6%)	
Any screen before oral intake?			<0.001
No	836 (60.7%)	125 (25.8%)	
Yes	541 (39.3%)	359 (74.2%)	
MNDS administered			NA
No	0	249 (40%)	
Yes	0	389 (60%)	
Pneumonia			<0.001
No	1555 (93.5%)	618 (97.2%)	
Yes	108 (6.5%)	18 (2.8%)	
Discharge status			0.21
Home	637 (39.3%)	209 (32.3%)	
Home with/without healthcare	119 (7.3%)	39 (6.0%)	
Rehabilitation	314 (19.4%)	128 (19.8%)	
SNF	186 (11.5%)	88 (13.6%)	
Other hospital	76 (4.7%)	37 (5.7%)	
Hospice	50 (3.1%)	15 (2.3%)	
Death	232 (14.3%)	131 (20.2%)	
AMA	9 (0.6%)	1 (0.2%)	

AMA indicates left against medical advice; ICH, intracerebral hemorrhage; MNDS, modified nursing dysphagia screen; NIHSS, National Institutes of Health Stroke Scale; SAH, subarachnoid hemorrhage; SNF, skilled nursing facility; and TIA, transient ischemic attack.

screened with the MNDS, 213 (49.7%) patients failed, automatically triggering a speech pathology bedside evaluation. The proportion of patients screened by other methods (MASA, Modified-MASA, or speech pathology alone) stayed relatively stable from preintervention to postintervention (12.9% versus 8.2%). Among the different stroke subtypes, nontraumatic SAH had the highest dysphagia screen failure rate at 77.7%. This was followed by intracerebral hemorrhages (52.7%) and ischemic stroke (48.7%). Not surprisingly, transient ischemic attacks showed the lowest failure rate with only 13.2% of patients failing their dysphagia screen. The doubling of dysphagia screening postinitiative from 26.2% to 52.7% in nontraumatic SAHs signifies a large change in the capture rate of the population most likely to fail dysphagia screening (Figure 2).

Implementation of the Screening Initiative Correlated With a Decrease in Hospital-Acquired Pneumonias

Concurrent with the screening initiative, a marked decrease in hospital-acquired pneumonias among patients with stroke was observed. The cumulative pneumonia prevalence fell from 6.5% preinitiative to 2.8% postinitiative (Table 2; $P<0.001$). Likewise, a significant inverse correlation existed between the decreasing hospital-acquired pneumonias and the percentage of patients screened (Pearson $r=-0.59$; $P<0.05$; Figure 3). Similarly, patients with stroke admitted after implementation of the screening quality initiative had 57% lower odds of acquiring pneumonia after controlling for age, sex, race, and diagnosis, (OR=0.43; 95% CI, 0.255–0.711; $P=0.0011$; Table 2). The model correctly predicted pneumonia status for 70.5% of patients with adequate model fit (area under the receiver-operating characteristic curve=0.7056; Hosmer–Lemeshow $P=0.6272$). However, screening was not perfectly implemented in all patients. Therefore, a second analysis was performed comparing screened subjects with unscreened subjects, regardless of whether they were admitted before or after the initiative. This analysis yielded almost identical results with screened patients being much less likely to develop pneumonia after controlling for covariates (OR=0.43; 95% CI, 0.232–0.790; $P=0.0066$).

In a third analysis, we compared patients with stroke who were screened using the MNDS to those who did not receive the MNDS screening after implementation. Counterintuitively, no difference in pneumonia prevalence was observed between the screened and unscreened in the postinitiative population (2.4% versus 3.1%; $P=0.571$). Moreover, patients who remained NPO before screening were more likely to develop pneumonia (OR=1.7; 95% CI, 1.020–2.960; $P=0.0421$). Although this could be attributable to increased pneumonia prevalence among screened patients, the more reasonable explanation is that the MNDS was administered to more severely ill patients. Patients screened with the MNDS had significantly higher NIHSS scores (10.7±6.2 versus 5.3±4.8; $P<0.001$) and were more likely to be admitted to the intensive care unit (90.2% versus 30.6%; $P<0.001$). Likewise, these patients were more likely to have poor disposition at discharge. Patients who died or were sent to hospice have 1.4×

the odds of being screened when compared with patients who were discharged home (Logit model; 95% CI,=1.043–1.845; $P=0.0244$). Similarly, patients who were sent to a skilled nursing facility had 1.4× the odds of being screened as well (95% CI, 1.029–1.874; $P=0.037$).

Next, we determine the factors most predictive of pneumonia in this population. A stepwise selection routine was used to determine whether treatment group (ie, preinitiative or postinitiative), age, sex, race, final diagnosis, NPO status, screening status, admitting unit, or MNDS administration predicted pneumonia in these patients. Diagnosis ($P<0.0001$), NPO status ($P<0.0001$), screening status ($P=0.0037$), and whether or not the patient was admitted before or after the initiative (treatment group; $P=0.0449$) were the best predictors of pneumonia. Patients who had intracerebral hemorrhage (OR=2.4; 95% CI, 1.198–4.867) and SAH (OR=3.2; 95% CI, 1.705–5.989) were significantly more likely to develop pneumonia than patients with ischemic stroke. Likewise, none of 217 patients who had a transient ischemic attack developed pneumonia. As above, patients who were kept NPO before screening were more likely to develop pneumonia (OR=10.6; 95% CI, 5.268–21.48). Age did not seem to be a significant factor in the development of pneumonia. NIHSS on admission was excluded from this analysis because of low reporting rates (19%) in this population.

Effect of the MNDS on Speech Pathology Consults

During the study period, the average monthly consults to speech pathologists increased from 153 per month in the year before the initiative to 179 per month in the year after the initiative ($P<0.01$). However, this was a continuation of a slow progressive increase without any significant change attributable to the initiative. More significantly, after implementation of the MNDS, nurses triggered 21 new dysphagia consults per month without a physician order. A special dispensation was made for this initiative in which the completed MNDS with a positive finding was sufficient to order the consult. This was then entered in the chart and cosigned by the physician at a later date. Nurse-initiated requests constituted 11.5% of the total monthly dysphagia consults. Furthermore, the Speech Language and Hearing Sciences Department felt that the nurse-generated consults were merited and did not burden the department.

Discussion

Here, we describe a multidisciplinary quality improvement initiative to increase dysphagia screening among patients with stroke. Our intervention consisted of education, improved order sets, and implementation of a bedside nursing dysphagia screen followed by streamlined dysphagia evaluations by speech pathologists. First, nursing education was achieved by online education modules. Second, implementation of the MNDS increased dysphagia screening in patients with stroke from 39.3% to 74.2%. Third, process improvements resulted in 11.5% of speech pathology referrals being generated directly by nurses, without a physician order. Finally, this initiative correlated with a decrease in the pneumonia prevalence from 6.5% to 2.8% among patients with stroke.
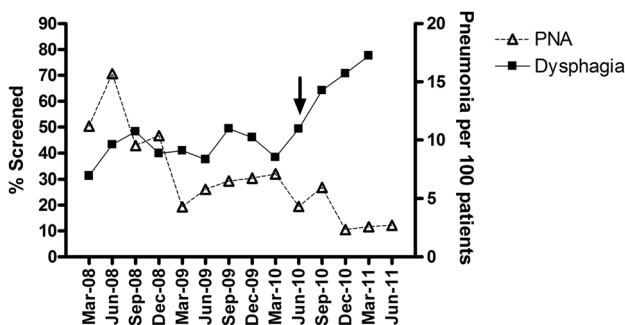

Figure 3. Correlation of the quarterly dysphagia screening prevalence and the number of pneumonias (PNAs) treated per 100 patients with stroke. Initiation of the Modified Nursing Dysphagia Screen (arrow) coincided with increased percentage of patients being screened for dysphagia (dysphagia), whereas the number of treated pneumonias among patients with stroke decreased.

The findings in this study are consistent with and extend those from previous reports. The efficacy of standardized protocols in acute stroke care has been previously demonstrated. In the Quality in Acute Stroke Care (QASC) study, 19 acute care stroke units were randomized to receive treatment protocols for fever, hyperglycemia, and swallowing dysfunction. Patients at intervention sites were significantly less likely to be dead or dependent (modified Rankin Scale ≥2; 42% versus 58%; P=0.002) and showed better mean physical component summary score on the Short Form (36) Health Survey (45.6 versus 42.5; P=0.002). However, although dysphagia was a component of the protocol, pneumonia was not an outcome measured in this study.[12]

In a retrospective analysis of the GWTG database from 2003 to 2009, Masrur et al[27] analyzed dysphagia screening and hospital-acquired pneumonia (HAP) from 314 007 patients with ischemic stroke. Similar to the findings presented here, the authors showed that 68.9% of patients nationally underwent dysphagia screening and 5.7% developed HAP. In their analysis, patients with pneumonia were more likely to have high NIHSS (median, 10 versus 4), were more likely to undergo dysphagia screening (75.5% versus 68.5%), and had increased length of stay and in-hospital mortality (12.4% versus 2.3%). Similarly, the current study found type of stroke and dysphagia screening to be strong predictors of pneumonia.

Odderson et al[4] analyzed the effects of a loosely defined swallow management protocol on pneumonia rates. In the single-center study of 124 patients with ischemic stroke, 39% of patients failed the screening and required altered diets, but no patients developed aspiration pneumonia. Shortcomings of this study include the use of historical controls, failure to show protocol compliance, and no comparison of patient characteristics preintervention and postintervention.[28] Later Hinchey et al,[10] in a cross-sectional study, found that pneumonia rates at hospitals without a formal dysphagia screen were 5.4% versus 2.4% at sites with a formal screen. These results are remarkably similar to our preintervention and postintervention rates of 6.5% and 2.8%, respectively.

Finally, an abstract by Mohr et al[29] reported the implementation of the Modified MASA among 100 patients with stroke in a single teaching hospital. These investigators found that 47% (95% CI, 37%–57.2%) of patients with stroke had swallowing impairment. This was also similar to our finding that 49.7% patients had ≥1 positive finding on the MNDS, suggesting a similar sensitivity. Furthermore, they showed a significant improvement in the incidence of poststroke pneumonia from 12% in 2008 to 3% in 2010. Although these authors used a validated dysphagia screen, they compared their results with historical controls, and no attempt was made to correct their pneumonia prevalence for possible confounders.

In contrast to previous studies, such as that of Sellars et al,[30] we did not find age to be a strong predictor of pneumonia after acute stroke. However, SAH composed of 26% of the study population but was not included in most of the previous investigations. These patients tend to have a high prevalence of dysphagia and be younger as indicated by the nearly 10-year difference in mean population age. Inclusion of this population could balance the effect of age on pneumonia explaining the current results.

The current study must be interpreted in the context of the study design. We used a prospective interrupted time series design. Therefore, our observations are limited to association and not causality. Nonetheless, the rise in dysphagia screening is temporally associated with a strong decrement in pneumonia prevalence. Furthermore, both of these events coincide with initiative implementation that strongly suggests their interrelation. Although randomization is ideal, its implementation would have been extremely difficult. This study was more than a simple screen in isolation. It was a multidisciplinary quality initiative involving education, increased screening, protocol development, and process improvement simultaneously performed in multiple units and departments. Furthermore, given the current strong recommendation for dysphagia screening in patients with stroke, randomization would have been unethical.

Second, bedside swallow screenings are inexpensive, have high compliance, and report sensitivities ranging from 42% to 96%.[14–17,31] Although the dysphagia screen developed by Anderson et al[22] has been validated, the MNDS in its current form, without an oral trial, has not been validated. This report details the real-world application of a dysphagia screen. In this institution, the use of an oral trial was logistically difficult and therefore its elimination increased compliance and resulted in improved outcomes. This underscores the need for individualized approaches to guideline compliance. However, the sensitivity and specificity of the MNDS are currently being assessed at our institution.

Third, intubation status was not recorded in a prospective manner, and NIHSS was not consistently assessed on admission and therefore could not be included in the analysis. Finally, given the study design, other unforeseen factors may have largely impacted discharge disposition and mortality.

This study presents the results of a single-center, comprehensive, dysphagia screening initiative. This initiative quickly increased compliance with the national guidelines. We also showed that this screening initiative correlated with decreased odds of pneumonia among patients with stroke by 57%. It bears mentioning that we do not think the screen used in this study, without an oral challenge, has the same validity as the better studied bedside screens referenced in this article. Rather, our focus was on the implementation of a screening initiative, in our clinical setting, and measurement of its effect on hospital-acquired pneumonia in a large stroke population. Our aim was validating the process and not the screen itself. Clinical evaluation by a trained speech pathologist remains the gold standard and cannot be, nor should be, replaced by a nursing-administered bedside screen. Rather, we have shown that implementation of a nurse-administered screening protocol can be used as part of a multitiered system of dysphagia evaluation in patients with stroke. Furthermore, implementation of this dysphagia screening protocol correlated with a reduction in pneumonia prevalence among patients with stroke in this institution.

Disclosures

None.

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Prospective Quality Initiative to Maximize Dysphagia Screening Reduces Hospital-Acquired Pneumonia Prevalence in Patients With Stroke

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