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Dysphagia Screening to Prevent Hospital-Acquired Pneumonia Rates

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by

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Abstract

Problem Pneumonia is a leading cause of death worldwide and affects all ages. Pneumonia may be acquired by aspiration and a bedside nursing dysphagia screen may reduce hospital acquired pneumonia (HAP) rates for stroke patients. The aim of this study was to evaluate use of the dysphagia screen for all patients receiving a computed tomography (CT) scan of the head in the emergency department (ED).

Method An observational, descriptive design for all patients who received a CT of the head in the ED and admitted over a 60-day period. The rate of dysphagia screening with the DePaul Hospital Swallow Screen and/or the Burke three-ounce water test was assessed. In addition, the type of diagnosis and rate of HAP was evaluated for those patients who were admitted to the hospital and compared to the HAP rates during the same time period a year prior.

Results There were 621 patients (*N*=621) who had a CT performed in the ED. Of those, 95.3% (*n* = 591) received dysphagia screening. The presenting diagnoses were AMS (74.9%, *n*=465), stroke (38%, *n*=81), trauma (10%, *n*=64), tumor (2%, *n*=9), syncope (0.1%%, *n*=1), and seizure (0.1%, *n*=1). The hospital rate of HAP was 12.6% in 2018 and 9.9% in 2019. A decrease in HAP was 2.7% (t =-2.561, $p < 0.01$) over the two-months when the dysphagia screen was implemented for all patients.

Implications For Practice Performing a dysphagia screen prior to oral intake in patients who receive a head CT in the ED may reduce inpatient HAP rates.

Dysphagia Screening to Prevent Hospital Acquired Pneumonia

Pneumonia is a common health problem affecting all age groups around the world and a leading cause of death among infectious diseases (Yang et al., 2013). Pneumonias are classified as community-acquired pneumonia (CAP), hospital-acquired pneumonia (HAP), also known as nosocomial pneumonia, and ventilator-associated pneumonia (VAP) (Yang et al., 2013). Pneumonia that is hospital-acquired is defined as pneumonia occurring 48 hours or more after hospital admission and not present at time of admission (Pugh, Grant, Cook, & Dempsey, 2015). Among hospital-acquired infections, HAP is the leading cause of death estimated to range from 20% to 50% (Stern et al., 2017). Aspiration pneumonia is a form of HAP, ranking as the number one of cause of mortality for post-stroke patients (Behera et al., 2018). Stroke is the leading neurological cause of dysphagia affecting 42% to 67% of patients within three-days of stroke (Donovan et al., 2013). Dysphagia is defined as difficulty swallowing and occurs in up to two-thirds of stroke patients, leading to serious complications such as aspiration and pneumonia (Palli et al., 2017).

Arnold et al. (2016) demonstrated a three-fold increased risk of pneumonia in patients with dysphagia and an eleven-fold increased risk in those with aspiration. Fifty percent of patients who present with dysphagia will aspirate, and one-third of patients who aspirate will develop pneumonia (Donovan et al., 2013). The cost of aspiration pneumonia is estimated to range from $13,000 to $16,000 per episode (Titsworth et al., 2013). Patients with aspiration pneumonia have higher mortality rates than controls and significantly poorer long-term clinical outcomes (Titswoth et al., 2013). The American Stroke Association (ASA) and other societies such as the American Speech-Language-

Hearing Association and the Veterans Health Administration recommend screening for dysphagia in patients with suspected stroke prior to the oral consumption of food, liquid, and/or medications (Behera et al., 2018). Furthermore, the high association among HAP, aspiration, and dysphagia has led to the use of bedside nursing dysphagia screening as an important step in decreasing morbidity and mortality.

The purpose of this quality improvement initiative was to evaluate the effect on HAP when an evidence-based bedside nursing dysphagia screening was used on any patient undergoing a head computerized tomography (CT) in the emergency department (ED). Dysphagia screening included the DePaul Hospital Swallow Screen (DHSS) and/or the Burke three-ounce water test. The aim of this study was to perform the dysphagia screening within 12 hours of arrival or before any oral intake. Prior to July 2018, dysphagia screening was only done for stroke patients. After a head CT scan, some patients were not diagnosed with stroke, but instead were diagnosed with trauma-related injuries, altered mental status (AMS), falls, syncope, seizure, dementia, sepsis, and urinary tract infections. Thus, the goal of this project was to reduce HAP rates among all patients requiring a head CT and who might be having neurological deficits. The questions for study included: For every head CT completed in the ED between February 1 through March 31, 2019,

1. What was the utilization rate of the DHSS screening tool/Burke water swallow test in patients who were admitted from the ED?
2. What were the most common chief complains for obtaining a head CT?
3. What was the rate of HAP for stroke patients during February 1-March 31, 2018 compared to February 01-March 31, 2019 who were admitted from the ED?

4. What was the rate of HAP for all patients admitted from the ED from February 1-March 31, 2019 when dysphagia screening was implemented?

Review of Literature

Several search databases were used: Cochrane Library, Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCO HOST, and PubMed. The keywords utilized were dysphagia screening; stroke; hospital-acquired pneumonia; aspiration pneumonia; and emergency department.

Aspiration pneumonia is a risk with stroke patients. Factors such as a stroke-associated pneumonia (SAP) history may be important to consider in determining aspiration risk. A retrospective study by Hannawi et al. (2013) was performed to determine the incidence, risk factors, prognosis, and cost of acute SAP since SAP has been found to increase morbidity and mortality. They found the incidence and prognosis of SAP among intensive care unit (ICU) patients has not been thoroughly investigated; therefore, they could not determine incidence, risk factors and prognosis (Hannawi et al., 2013). However, the annual cost of SAP during hospitalization in the United States was estimated to be $459 million (Hannawi et al., 2013).

Physical symptoms resulting from stroke, such as dysphagia, may be an indicator for aspiration risk. Arnold et al. (2016) assessed the incidence of dysphagia in stroke patients and compared clinical outcomes after three months. There were total of 570 consecutive patients with ischemic strokes who were evaluated by using the Gugging Swallowing Screen (GUSS) (Arnold et al., 2016). Dysphagia affected more than one in five patients with ischemic stroke and was independently associated with HAP, discharge

destination and institutionalization, while severe dysphagia was a strong predictor of unfavorable outcome and mortality at 3 months (Arnold et al., 2016).

Dysphagia screening may be an essential step in the management of stroke patients to predict, determine, and prevent the immediate risk of aspiration (Behera et al., 2018). A prospective observational study was performed to evaluate a dysphagia screening instrument developed at DePaul Hospital in St. Louis, Missouri, a designated comprehensive stroke center by The Joint Commission (Behera et al., 2018). The DHSS instrument was developed to assess for dysphagia in patients with stroke. Behera et al. (2018) studied nursing staff screening for all patients admitted under a standard stroke protocol by using the DHSS, and a speech-language pathologist evaluated patients using the Mann Assessment of Swallowing Ability (MASA) for a five-month period. The validity of the non-swallow items in the DHSS was assessed by subject matter experts and measured quantitatively by a Content Validity Index (CVI) method. The CVI of 92% suggested a high validity and provided a gauged agreement for the significance of this tool. The results of this study found the DHSS had a specificity of 90% and a sensitivity of 70% (Behera et al., 2018). The DHSS appeared to be a valid and reliable swallow-screening instrument with moderate agreement and reliable predictive values when compared with the MASA (Behera et al., 2018).

When comparing the DHSS tool to other screening tools, a study by Edmiaston, Connor, and Loehr (2010) compared seven swallow-screening instruments to their acute stroke dysphagia screening (ASDS) and found a lack of validation in most tools. The ASDS included the Glasgow coma scale for evaluating level of consciousness and three more items, including weakness or asymmetry in facial, lingual, and palatal movements,

before proceeding to the water swallow test (WST). The ASDS did not consider previous dysphagia history, drooling, voice, or cough quality (Edmiaston et al., 2010). The DHSS did incorporate previous histories and overall, the DHSS sustained high specificity and negative predictive values suggesting patients with an initial diagnosis of stroke and the ability to pass the DHSS are likely to safely proceed with oral intake (Behera et al., 2018). However, further studies are needed to evaluate the use of the DHSS in stroke patients and if it lowers the risk of actual aspiration pneumonia during the acute hospital stay (Behera et al., 2018).

DePippo, Holar, and Reding (1994) conducted a study to test the effectiveness of the Burke Dysphagia Screening Test (BDST), which is a second step in DHSS instrument, and is a WST. DePippo et al. (1994) studied an inpatient rehabilitation unit for a 12-month period with one hundred thirty-nine patients admitted after stroke. BDST identified 11 of 12 patients who had developed pneumonia, recurrent upper airway obstructions, or death (DePippo et al., 1994). The BDST had contained seven features, where only one feature (a 3-oz WST) seemed to be the best indicator (DePippo et al., 1994). The results of this study indicated that relative risk for developing pneumonia, recurrent upper airway obstructions, or death was 7.65 times greater for patient failing the BDST (DePippo et al., 1994). The BSDT had identified 92% of patients who developed pneumonia, recurrent upper airway obstruction, or who died during their inpatient stay (DePippo et al., 1994). The BDST may be a useful tool in identifying patients with dysphagia who are at risk for aspiration and who may require further evaluation by speech pathology.

Nurse screening and speech pathology evaluations may identify those at risk for aspiration. A study by Titsworth et al. (2013) was conducted to determine if a bedside nursing dysphagia screen and reflexive rapid swallow evaluation by a speech pathologist would increase screening and decrease pneumonia prevalence in stroke patients at a 852-bed, tertiary care center with a Joint Commission designated Primary Stroke Center. Titsworth et al. (2013) found the bedside dysphagia screening increased identification for those at risk for aspiration from 39.3% to 74.2% ($p<0.001$) in stroke patients. Also, there was a decrease in HAP from 6.5% to 2.8% among patients with stroke ($p<0.001$) (Titsworth et al., 2013). Overall, the nurse-administered bedside screen with rapid bedside swallow evaluation by a speech pathologist improved screening compliance and correlated with a decreased prevalence of pneumonia among patients with stroke.

The assessment of swallow is important in determining aspiration risk. Rosenbek et al. (2004) determined the relationship between symptoms elicited by a clinical swallowing examination (CSE) and aspiration on a subsequent video-fluoroscopic swallowing examination (VFSE). They found the CSE can define the biomechanical abnormalities responsible for signs of dysphagia, including aspiration, and identified a spontaneous cough and wet voice after the WST were significant predictors of dysphagia and aspiration (Rosenbek et al., 2004). Hence, a WST is an important physical screening indicator for aspiration risk.

Other physical attributes may be important to consider when assessing for aspiration risk. Leder, Suiter, Murray, and Rademaker (2013) investigated whether components of an oral mechanism examination, such as binary judgments (complete/incomplete) of labial closure, lingual range of motion, and facial symmetry,

were associated with increased risk of aspiration. A total of 3,919 consecutive inpatients from a large, urban, tertiary-care teaching hospital were able to participate in an oral mechanism examination followed immediately by a fiberoptic endoscopic evaluation of swallowing. Participants with incomplete lingual range of motion had a risk for aspiration 2.72 times the risk of those with complete lingual range of motion ($p < 0.0001$). Incomplete lingual range of motion was an independent risk factor for aspiration regardless of labial closure and facial symmetry (Leder et al., 2013). Participants with incomplete facial symmetry had risk of aspiration that was 0.76 times the risk of aspiration of those with complete facial symmetry ($p = 0.017$). Thus, incomplete lingual range of motion and incomplete facial symmetry increased the risk of aspiration during subsequent instrumental dysphagia testing (Leder et al., 2013).

A speech pathology evaluation may be important in determining aspiration risk. Eltringham et al. (2018) performed a systematic review to examine usage of a standardized screening protocol that included early dysphagia screening (EDS) and assessment by a speech and language pathologist (SLP). This study evaluated dysphagia screening, assessment or management within the first 72-hours of inpatient admission, and recorded frequency of SAP (Eltringham et al., 2018). A total of twelve studies with a 87,824 ischemic and hemorrhagic stroke patients, including six studies that analyzed associations between dysphagia screening and SAP were reviewed (Eltringham et al., 2018). They found delays in SLP assessment were associated with SAP with an absolute risk of pneumonia incidence of 1% per day of delay (Eltringham et al., 2018). This provides increased evidence of early dysphagia screening and specialist swallow assessments may reduce the risk of SAP (Eltringham et al., 2018).

Deming's Plan-Do-Study-Act (PDSA) cycle is an integrated learning and improvement model using a systematic process for gaining valuable learning and knowledge for the continual improvement of a product, process, or service (W. Edwards Deming Institute, 2018). The PDSA cycle is a preferred framework and scientifically valid process for guiding the process of change. Testing the change in small, incremental cycles allows for measurement of select outcomes and adjustments in the process before the next cycle of change occurs. Deming's PDSA framework serves as a guide for most quality improvement initiatives and was the framework used for this study.

Methods

Design

An observational, descriptive cohort design using a PDSA cycle was completed. A team of key stakeholders included a multiple-disciplinary subcommittee of the primary investigator (PI), stroke coordinator, ED educator, team leaders from ED, therapy, and inpatient nursing units, hospital educators, speech pathology and therapy assisted in the development of this study.

Setting

The ED is a level 1 trauma center in a Midwestern, urban academic medical center. This hospital is also a level 1 time critical diagnosis hospital in stroke, trauma and ST Elevation Myocardial Infarction. The ED treats more than 80 ED visits each day. The medical center is located in a metropolitan area with over three million residents.

Sample

The primary sample was a convenience sample of patients receiving a head CT in the ED from February 1 through March 31, 2019. The inclusion criteria were age ≥ 18-

years, a head CT obtained in the ED, and admission to the hospital from the ED. Exclusion criteria included age < 18-years, not having head CT completed in ED, being a direct admission, and not being admitted to the hospital from the ED. The secondary sample was also a convenience sample with the same criteria but during February 1 through March 31, 2018.

Approval Processes

The hospital and university committees approved this quality improvement project. The project obtained approval from the hospital's institutional review board (IRB) and from university IRB. There were no known risks or ethical considerations related to this study, as this is a retrospective medical record review.

Data Collection/Analysis

Data was collected by a retrospective medial record review from February 1 through March 31, 2018 and 2019. Data was collected by using electronic health record (EHR) specialists who de-identified patient records prior to analysis. The first review occurred between February 1, 2018 and March 31, 2018 examining the HAP rates for all admitted patients from the ED. The second review occurred between February 1, 2019 and March 31, 2019 examining the HAP rates for all admitted patients from the ED. Data analysis occurred with SPSS (Statistics 25) and Excel Microsoft programs and used to compute statistical outcomes using an independent *t*-test.

Procedures

In July 2018, the hospital adopted a revised policy for nursing to utilize the DHSS screening tool and proceed to the Burke 3-ounce WST if the patient passed the DHSS for any patient receiving a CT scan of the head in the ED. This two-step policy included

education for the ED staff. The approved policy change incorporated a standard for the ED nurses to complete the bedside nursing dysphagia screening in for every head CT performed. The DHSS/Burke WST screening tool was discussed during educational sessions including but not limited to daily huddles, staff meetings, newsletters, public postings, an online education module, and an initial education module in employee nursing orientation.

Results

Summary descriptive statistics, frequencies and percentages were obtained. Between February 1-March 31, 2019, there were a total of 621 patients (*N*=621) who received a head CT in the ED. The most common age range of patients who received CT scan of the head was 61-70 years (*n*=133, 21.4%), then 51-60 years (*n*=126, 20.3%), 71-80 years (*n*=111, 17.9%), 21-40 years (*n*=106, 17.1%), 81-90 (*n*=68%, 11%), 41-50 years (*n*=62, 10%), and 91-100 years (*n*=15, 2.4%). The most frequently observed category of gender was male (*n* = 373, 60.1%) versus female (*n*=248, 39.9%). The most frequently observed category of race/ethnicity was White (*n* = 370, 60%), then Black (*n*=235, 38%), Asian (*n*=8, 1.3%), Hispanic (*n*=4, 0.6%), and Pacific Islander (*n*=1, 0.16%). Three patients did not have race/ethnicity recorded. The most frequently observed chief complain to visit the ED to receive a head CT was AMS (*n* = 465, 75%), then stroke (n=81, 13%), trauma (n=64, 10%), tumor (n=9, 1.4%), syncope (n=1, 0.16%) and seizure (n=1, 0.16%) (Appendix B).

Of the 621 patients in the 2019 sample, 95.3% (*n* =591) of them received a DHSS/Burke WST screening. Between February 01-March 31, 2019, there were total of 116 who were diagnosed with stroke, where 8 (7%) were diagnosed with HAP. In

comparison to 2018, there were 116 patients, 9 (8%) were diagnosed with HAP. An independent *t*-test was performed, which indicated the rate of HAP in 2018 versus 2019 was not significantly different (t= -.2561, df= 230, p=.802). Because the variances were not significantly different, a *t* test that did assume equality of variances was conducted.

Rates for all admitted patients from the ED between February 1-March 31, 2019 were 1873, with 185 (9.9%) who developed HAP. The rate for all admitted patients from the ED between February 1-March 31, 2018 was 1625, with 205 (12.6%) who were diagnosed with HAP. An independent *t*-test was performed comparing the HAP rates in admitted patients from the ED. The number for the 2018 sample was 205 and is significantly higher than the number for the 2019 sample of 185 at the .05 level (t= -2.561, df=3289.37, p=.000). Because the variances were significantly different, a *t* test that did not assume equality of variances was conducted. A decrease of 2.7% from 2018 to 2019 was statistically significant.

Discussion

The number of patients who had a DHSS/Burke WST done was clinically significant. The first study question found the overall dysphagia screening rate in 2019 was 95.3%, demonstrating remarkable adherence to the new nursing practice policy to screen all patients for dysphagia if a head CT was ordered. When analyzing the chief complaints for the visit to the ED for all patients receiving a head CT (the second study question), nearly 75% had a chief complaint of AMS for the purpose of the CT, followed by stroke, trauma, tumor, syncope, and seizure (Appendix B).

The third question of study compared HAP in stroke patients from 2018 to 2019. The rate of HAP for stroke patients was 8% in 2018 versus 7% in 2019. Initially, there

were 81 patients who came into the ED with chief complaints of stroke symptoms and required a head CT, but additionally 35 patients who initially came into the ED other than stroke symptoms were diagnosed with stroke after diagnostic testing and evaluation. There were total of 116 stroke patients who were admitted from ED between February 1-March 31, 2019, with 8 (7%) who had developed HAP. A total of 116 stroke patients from the ED were admitted and of these 116, 9 (8%) had developed HAP. The results indicated the rate of HAP in 2018 versus 2019 was not significantly different.

The fourth study question found the overall rate of HAP between February 1 and March 31, 2018 being 12.6% and the February 1 through March 31, 2019 rate being 9.9% in patients admitted from the ED. The occurrence rate decreased 2.7% (n=50) when dysphagia screening occurred for all patients who underwent a head CT in the ED in 2019. This finding was clinically significant since at least 50 patients avoided the comorbid condition of HAP and its consequences. Dysphagia screening appeared to influence the rate of HAP for all patients admitted who underwent a head CT in the ED, not just stroke patients.

As of February 2019, the hospital dysphagia policy which included the DHSS/Burke WST was performed on nearly every patient who might have been at risk for aspiration, especially those undergoing a head CT in the ED. Bedside nursing dysphagia screening may take up to five-minutes to perform, but the five-minutes may help reduce HAP rates in patients who might be risk for aspiration. Performing a dysphagia screen for every head CT appeared beneficial for reducing HAP in those with a non-stroke diagnosis. The standardized screening instrument was sensitive to detect swallowing issues in patients that may not have been detected previously. Essentially

unchanged results of HAP rates in stroke patients do not diminish the importance of recognizing that patients with other diagnoses who are experiencing dysphagia might benefit from being screened to prevent aspiration pneumonia.

Implications for practice would be to include continued dysphagia screening for patients at risk for aspiration pneumonia. Continuing education from speech pathology experts to nurses regarding dysphagia screening would be an additional consideration to reduce overall HAP. Finally, to maintain staff adherence to dysphagia screenings, monthly audits should occur and be discussed during monthly staff meetings and morning huddles. Continued encouragement and support should be provided.

Recommendations for future research on the utilization of dysphagia screening for non-stroke diagnoses might provide ongoing support of this as effective in reducing the rate of HAP beyond the stroke patient. Additionally, analyzing the efficacy of improving the dysphagia documentation rate after the implementation of a Best Practice Advisory (BPA), to evaluate the impact on HAP rates among stroke patients. Further study is needed to validate findings from this study.

Conclusion

A standardized dysphagia screening process appeared effective in reducing HAP rates in patients who underwent a head CT in the ED, including non-stroke diagnoses such as AMS and trauma. While a stroke diagnosis has traditionally been the reason for performing a dysphagia screening, this study provided evidence on the benefit of dysphagia screening for any patient that might need a head CT. The prevention of HAP, especially aspiration pneumonia, is essential in reducing the incidence of HAP.

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Appendix A

Table 1
2019 Age Ranges and Presenting Diagnosis

	Presenting Diagnosis						
	Stroke	AMS	Trauma	Tumor	Syncope	Seizure	Total
21-40 years	4	71	26	4	0	1	106
41-50 years	3	49	10	0	0	0	62
51-60 years	16	98	9	3	0	0	126
61-70 years	29	97	5	1	1	0	133
71-80 years	20	84	6	1	0	0	111
81-90 years	9	52	7	0	0	0	68
91-100 years	0	14	1	0	0	0	15
Total	81	465	64	9	1	1	621

Appendix B

Figure 1. Presenting Diagnoses for Patients Receving Head CT in ED

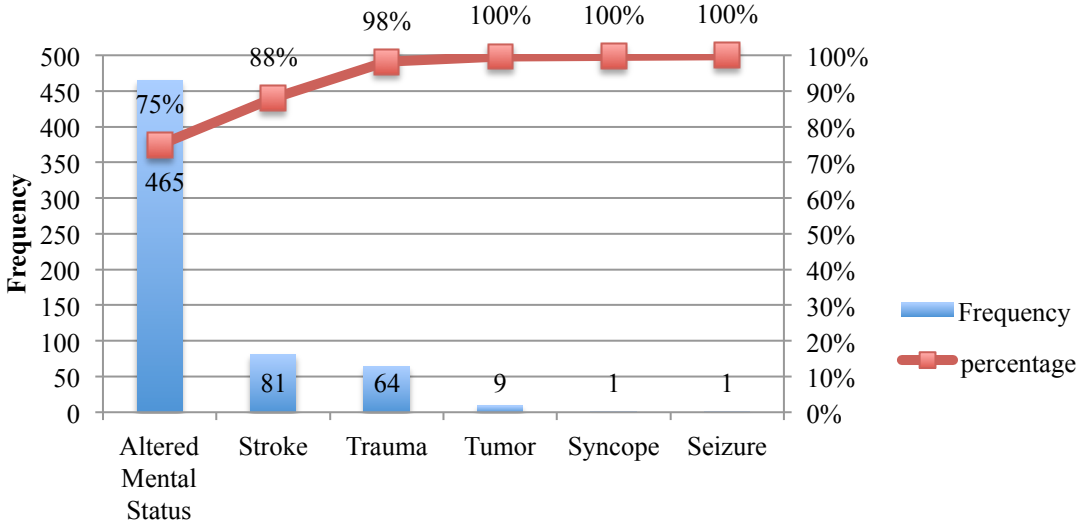

Figure 1. Presenting Diagonses for Patients Receiving Head CT in ED.