Comparative Analysis of Two Swallow Screening Tools

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Declarations of interest: none

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Abstract

Background: Dysphagia after stroke is common and is associated with an increased risk of aspiration, dehydration, and malnutrition. Early identification can allow for interventions to reduce complications. **Aim:** This study evaluated the sensitivity and specificity of a modified Yale Swallow Protocol compared to a hospital developed bedside swallow screening tool. **Methods:** Retrospective matched case-control method was used to collect data and compare two different bedside swallow screening tools. Comparison was made with evaluations completed by a Speech Language Pathologist. Electronic health records (EHRs) were reviewed from a 90-day period using hospital developed swallow screening tool and a 90-day period using the modified Yale Swallow Protocol. Reviews included: ischemic stroke diagnosis; identification of bedside swallow screening tool used; SLP evaluation; gender; and age. Hospital developed swallow screening tool group included 169 patients. The modified Yale Swallow Protocol group included 192 patients. **Results:** 2018 diagnostic survey comparison against SLP yielded the following: Sensitivity (79.2%), specificity (85.7%), PPV (75%), NPV (88.4%), and diagnostic accuracy (83.4%). 2019 diagnostic survey comparison against SLP yielded the following: Sensitivity (56.1%), specificity (89.1%), PPV (76.2%), NPV (76.6%), and diagnostic accuracy (76.5%). **Conclusions:** Hospital developed bedside swallow screen was more sensitive to possible dysphagia while the modified Yale Swallow Protocol was slightly more specific. Both swallow screening tools perform equally well. This project was unable to identify a superior bedside swallow screening tool. The research illustrates the need for comprehensive training and competency validation of nursing staff.

Keywords: Yale Swallow Protocol, ischemic stroke, swallow screening, dysphagia screening, competency.

Background

The Centers for Disease Control and Prevention (CDC, 2018) report that stroke is the fifth leading cause of death in the United States, claiming roughly 140,000 lives annually. Approximately 795,000 people suffer a stroke each year. When a stroke occurs, it can affect any one or more of the twelve cranial nerves; of which six play a role in the process of swallowing. When these nerves are damaged the patient may experience swallowing difficulty, also known as dysphagia (Rubin, 2017).

It is estimated that 50% of patients with stroke experience dysphagia. While dysphagia eventually resolves in many of these patients, approximately 11-13% continue to have swallow dysfunction after six months. It is estimated that up to 80% of these patients require an alternative means for nutrition and hydration (Gonzalez-Fernandez, Ottenstein, Atanelov & Christian, 2013). Some data estimate that 15 million people worldwide suffer from stroke with as many as 65% experiencing some problem with swallowing. When the risk of aspiration related to dysphagia is identified early, steps can be taken to prevent secondary complications such as aspiration pneumonia, dehydration, and malnutrition (Cohen et al., 2016).

Videofluorographic swallowing study (VFSS), also known as a modified barium swallowing (MBS) study is the gold standard for evaluation of dysphagia. However, with the volume of patients typically seen at Comprehensive Stroke Centers, completing VFSS, or MBS, on every patient presenting with stroke or stroke-like symptoms is neither cost effective or practical. It is for this reason that, in the acute clinical setting, the nurse is typically responsible for initially screening patients with stroke or stroke-like symptoms for signs of aspiration related to dysphagia. The bedside swallow screen conducted by the nurse will determine the need for further evaluation. If a risk for aspiration is identified, a Speech Language Pathologist (SLP)

will evaluate the patient. After this formal evaluation, a physician or the SLP may complete a MBS evaluation to further establish or rule out a diagnosis of dysphagia (Gonzalez-Fernandez, et al., 2013).

Dysphagia Screening and Stroke

The true prevalence of dysphagia after stroke is difficult to accurately determine given differences in the timing, setting, and the screening tool used. However, it is known that patients with dysphagia are three times more likely to develop pneumonia, while those who have confirmed incidence of aspiration are eleven times more likely to develop pneumonia (Cohen, et al., 2016). Limited research has been performed in the area of dysphagia after a stroke event. In particular, there is limited information to direct clinical staff to the most reliable bedside dysphagia screening tool available. This gap in knowledge leads to limited information being available to guide the identification of aspiration risk related to dysphagia (Cohen et al., 2016).

The Centers for Disease Control and Prevention (2016) recommend that any patient aged 18 years or older who has been diagnosed with stroke should be evaluated for swallowing dysfunction, or dysphagia, prior to the oral intake of any liquid, food, or medication. Guidelines from the American Heart Association/American Stroke Association (2018) for the management of patients after acute stroke state that "it is not well-established which instrument to choose for evaluation of swallowing with sensory testing, but the choice may be based on instrument availability or other considerations" (p e36). These recommendations did not change with the publication of the 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke (American Heart Association / American Stroke Association, 2019).

When nurses can effectively screen for aspiration related to dysphagia at the bedside, the rate of pneumonia is reduced. This reduction in the incidence of aspiration pneumonia is felt to

be related to precautions that are put into place when a nursing assessment finds that a patient is at risk for aspiration. It is for this reason that nurses should conduct bedside screening for aspiration related to dysphagia in patients presenting with stroke or stroke-like symptoms in a timely manner (Palli, et al., 2017). In contrast, the argument has been made that there is insufficient data from randomized control trials to determine how effective dysphagia screening is in reducing secondary complications of stroke. It has been recommended that further studies be conducted to compare the effectiveness of different methods of screening for aspiration related to dysphagia (Smith, et al., 2018).

Aim

The purpose of this study was to evaluate the sensitivity, specificity, and predictive value of two different bedside swallow screening tools as compared to the gold standard of swallow evaluation completed by a Speech Language Pathologist in the acute hospital setting in patients diagnosed with ischemic stroke. Each swallow screening tool was compared independently against the SLP evaluation. Sensitivity, specificity, positive predictive value, negative predictive value, and total accuracy for each of the two swallow screening tools has been calculated. The diagnostic efficacy of the two assessments has been compared using a receiver operator characteristic analysis to identify which one accounts for more area under the curve.

The modified Yale Swallow Protocol (see Appendices A-C), a screening tool used by nursing staff to assess for aspiration related to dysphagia at the patient bedside, is one swallow screening method comparatively evaluated in this study. This tool has proven to be highly accurate, reliable, and cost efficient (Leder & Suiter, 2014). The second screening tool evaluated in this study has been adapted from multiple swallow screening tools at the host facility. Henceforth, the second screening tool will be referred to as a hospital developed nursing bedside

swallow screening tool (see Appendix D). The host facility developed this bedside swallow screening tool several years ago when initially seeking stroke certification. Review of data has not previously been conducted to evaluate accuracy or reliability of this screening tool at the host facility.

Orlando's Deliberative Nursing Process theory is effectively applied to bedside swallow screening as the bedside nurse directly observes the patient's behavior during the swallow screen. If the nurse perceives that the patient has any signs of aspiration related to dysphagia, further evaluation by the Speech Language Pathologist should be completed. This indirect help is provided by the nurse to meet the patient's needs. In the application of the bedside swallow screen, the nurse may identify and address immediate needs for airway protection, nutrition, and hydration. Deliberate action is taken by the professional nurse to respond to observed distress in the patient through utilization of a bedside swallow screening tool (Fawcett & DeSanto-Madeya, 2013).

Method

This project was an evidence-based practice (EBP) initiative to evaluate and compare the reliability of two different bedside swallow screening tools. The rationale for this study design was to evaluate reliability after implementation of an evidence-based bedside swallow screening tool through quantitative data collection and analysis. Data were compared between two different bedside swallow screening tools and compared with subsequent findings from formal evaluation completed by a Speech Language Pathologist in patients who share a similar diagnosis and characteristics (Moran et al., 2017).

Study Procedure

This study used retrospective electronic health record (EHR) extraction to compile data on patients discharged from the host facility with diagnosis of acute ischemic stroke. This retrospective method allows for data comparison between two different bedside swallow screening tools with additional comparison to subsequent evaluation completed by a SLP. Data were analyzed to make comparisons between two different bedside swallow screening tools. Total accuracy of the two assessment tools were compared to SLP evaluation results.

Patients and Setting

The sample and setting for this project included patients discharged with an ischemic stroke diagnosis in the acute hospital environment at a 541 bed, tertiary care, regional medical center within the East Tennessee area. This facility is recognized by The Joint Commission as a Comprehensive Stroke Center. The criterion for patient participation were discharge from the facility with an acute ischemic stroke diagnosis. The timeframe used for patient discharge to be included in data collection was January 1, 2018 to March 31, 2018 (90 days) and January 1, 2019 to March 31, 2019 (90 days). Based on data from the facility, 174 patients were discharged with an ischemic stroke during the first quarter of 2018. During the first quarter of 2019, the facility discharged 199 patients with the same diagnosis. A total of twelve subjects were excluded from this study (5 from the 2018 group and 7 from the 2019 group) for being admitted under observation status rather than inpatient hospital admission.

Data Collection Method & Instrument

Data for this project were collected through retrospective EHR audit. Data were collected from a period of 90 days (January 1, 2018 through March 31, 2018) during which time the hospital developed swallow screening tool was being used, and for a period of 90 days (January 1, 2019 through March 31, 2019) during which time the modified Yale Swallow

Protocol was being used. The following quantitative data were collected: patient age, sex, swallow screening tool utilized, result of swallow screening tool (pass/fail), evaluation by a SLP (pass/fail), MBS performed (yes/no) and result. Data were collected, organized, and stored in a password-protected Microsoft Excel document. This document served as a consistent, structured checklist to ensure that all appropriate information was collected from EHR audits. Accuracy of the data collected were achieved by administration of intra-rater reliability testing.

Results

Data were analyzed as a comparison between two different bedside swallow screening tools with total accuracy of the two assessment tools compared to SLP evaluation results. Calculations were made to determine sensitivity, specificity, positive predictive value and negative predictive value of both bedside swallow screening tools. Diagnostic efficacy of the two assessment tools were evaluated by using a receiver operator characteristic analysis to determine which one accounts for more area under the curve. Accuracy of the data collected were achieved by administration of intra-rater reliability testing.

Statistical Methods

Descriptive and frequency statistics were used to describe the demographic characteristics of the sample. The results (positive/negative) of the diagnostic surveys were compared against the "gold standard" (also positive/negative) using a cross-tabulation table and frequency statistics. Measures of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were calculated and reported. All analyses were performed using SPSS Version 26 (IBM Corp, 2017).

Statistical Results

The demographic characteristics of the sample are reported in Table 1. When the diagnostic survey in 2018 was compared to SLP, the following measures were generated: Sensitivity (79.2%), specificity (85.7%), PPV (75%), NPV (88.4%), and diagnostic accuracy (83.4%). For the 2019 diagnostic survey comparison against SLP, the following measures were yielded: Sensitivity (56.1%), specificity (89.1%), PPV (76.2%), NPV (76.6%), and diagnostic accuracy (76.5%). Table 2 and Table 3 present the cross-tabulation frequencies for each comparison.

Table 1.

Demographic Characteristics

Variable	Level	Statistic
Age 2018*	-	69.8 (13.4)
Age 2019*	-	68.9 (13.4)
Gender 2018**		
	Male	87 (51.5%)
	Female	82 (48.5%)
Gender 2019**		
	Male	87 (45.3%)
	Female	105 (54.7%)

Note: * Values are mean (standard deviation), ** Values are frequency (percentage)

Table 2.

Diagnostic Testing – 2018

	SLP positive	SLP negative
Test positive	42	14
Test negative	11	84

Table 3.

Diagnostic Testing – 2019

	SLP positive	SLP negative
Test positive	32	10
Test negative	25	82

Limitations

This project was limited by the abbreviated timeframe in which data were collected. A longer data collection timeframe may have revealed wider gaps in bedside swallow screen comparison. Additionally, this project did not look at training or the experience level of the nursing staff conducting these bedside swallow screens. This researcher can only attest to the education and competency validation of each bedside swallow screening tool prior to implementation in the host facility.

Discussion

This project was a comparative analysis of two different bedside swallow screening tools to calculate the sensitivity, specificity, and predictive value of each tool with comparison to the evaluation completed by a Speech Language Pathologist to determine reliability of each bedside

swallow screening tool. It was initially felt that the modified Yale Swallow Protocol would surpass the hospital developed swallow screening tool in terms of reliability. However, this study has shown that the true value of bedside swallow screening is more likely found in the comprehensive training and competency validation of nursing staff caring for patients with acute ischemic stroke. According to Portney and Watkins (2015), clinical experience should impact clinical decision making because such practice can be burdened by evidence, "for even excellent external advice may be inapplicable to or inappropriate for an individual patient" (p 9).

Conclusions

While this project was not able to identify a superior bedside swallow screening tool, the research illustrates the need for comprehensive training and competency validation of nursing staff. This research supports the use of nurse-driven protocols founded in evidence-based practice. Furthermore, this research supports Orlando's Theory of the Deliberative Nursing Process (Fawcett & DeSanto-Madeya, 2013) by illustrating that evidence-based, nurse-driven protocols allow nurses to conduct clinical assessments and appropriately implement critical decisions and treatment strategies in the best interest of the patient.

Implications for Nursing Practice

This project supports the development of nurse-driven, evidence-based protocols. With comprehensive training and competency validation, nursing staff will acquire clinical experience proven to have a positive impact in clinical decision making leading to improved outcomes (Portney & Watkins, 2015). This project supports the nursing profession and autonomy of nurses by illustrating the positive impact that training, experience, and application of evidence-based protocols have on patient care (AACN, 2015). Recognition of immediate patient needs and appropriate intervention by nursing staff promote prevention of complications as good

patient outcomes are directly related to effective nursing practice (Fawcett & DeSanto-Madeya, 2013).

Future Research

Further research on nurse-driven bedside swallow screening protocols that are conducted over a longer period of time may strengthen the evidence presented in this paper. Additionally, this research suggests a comparative study of other evidence-based bedside swallow screening tools. Further comparison between novice and experienced nursing staff may also strengthen the evidence presented in this paper.

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Appendix A

Modified Yale Swallow Protocol

Exclusion Criteria

Yes	No	
___	___	Unable to remain alert for testing
___	___	Unable to manage secretions (drooling, wet voice, requires oral suction)
___	___	No thin liquids due to pre-existing dysphagia
___	___	Head-of-bed restrictions <30°
___	___	Tracheostomy tube present
___	___	NPO for medical / surgical reason
___	___	Diagnosis of degenerative neuromuscular disorders:
		- Amyotrophic Lateral Sclerosis (ALS) - Guillain-Barre Syndrome (GB) - Multiple Sclerosis (MS) - Myasthenia Gravis (MG) - Brainstem stroke
___	___	Neurologic insult has resulted in compromised respiratory status/high oxygen demands (BiPAP, high-flow nasal cannula, non-rebreather mask).

A "YES" response to any of the above criteria immediately renders patient ineligible for further testing.

Do NOT proceed further. Do NOT administer water.

Author note: The Yale Swallow Protocol presented here is a reproduction of the procedure from the "Bedside Swallow Screen and Aspiration Precautions" policy that is in place within the health system. The Protocol has been modified for the facility's clinical use.

Appendix B

Modified Yale Swallow Protocol

Administration Instructions

Step 2: Brief Cognitive Screen:

Correct	Incorrect	
_____	_____	What is your name?
_____	_____	Where are you right now?
_____	_____	What year is it?
_____	_____	Open your mouth.
_____	_____	Stick out your tongue.
_____	_____	Smile

Step 3: Oral Mechanism Examination

_____	_____	Lip closure
_____	_____	Tongue movement
_____	_____	Facial symmetry (smile/pucker)

*Perform the 3-ounce water swallow challenge:

Sit patient upright at 80-90° (or as high as tolerated >30°).

Ask patient to drink the entire 3 ounces (90ml) of water from a cup or with a straw, in sequential swallows, and slow and steady but without stopping. (Note: Cup or straw can be held by clinician or patient.) Assess patient for interrupted drinking and coughing or choking during or immediately after completion of drinking.

Step 4: Administration Instructions for 3-Ounce Water Challenge

Perform only if patient has passed Step 1 with all NO responses.

Performance on Steps 2 and 3 is supplemental information to guide nursing in cautiously proceeding with the 3-ounce water challenge.

1. Sit patient upright as high as tolerated above 30 degrees. 90 degrees is optimal.
2. Ask the patient to drink entire 3 ounces (90ml) of water from a cup or with a straw using sequential swallows. Encourage the patient to drink slowly and steadily but without stopping.

3. Assess patient for coughing or choking during or immediately after completion of drinking.
4. It is permissible to repeat the 3-ounce water challenge an additional time if it is thought the patient may pass with another trial.

Author note: The Yale Swallow Protocol presented here is a reproduction of the procedure from the "Bedside Swallow Screen and Aspiration Precautions" policy that is in place within the health system. The Protocol has been modified for the facility's clinical use.

Appendix C

Modified Yale Swallow Protocol

Results and Recommendations

_____ PASS: Successful uninterrupted drinking of all 3 ounces of water without overt signs of aspiration (coughing/choking) during or immediately after completion.

- Call MD to obtain appropriate oral diet if no existing orders.
- Offer a soft or normal consistency diet if patient has adequate dentition.
- Offer a pureed diet if patient does not have sufficient ability to chew.

_____ FAIL: Inability to drink the entire 3 ounces in sequential swallows due to interrupted drinking (stopping/starting) or patient exhibits overt signs of aspiration (coughing/choking), during or immediately after completion.

- A failed swallow screen in the ED must be repeated when the patient moves to the unit/floor (this includes changing the patient's status to boarded while in ED).

- If the patient fails the bedside swallow screen on the second attempt, continue NPO status and alert Speech Language Pathologist. The patient is not eligible for additional nursing bedside swallow screens. If Speech Language Pathologist is not readily available (within 24 hours) the RN should contact the primary provider for orders addressing nutrition, hydration and medications.

- NOTE: Patients who fail the bedside swallow screen should not receive anything by mouth including medications in applesauce, pudding or other medium. The primary provider should be notified and small-bore feeding tube placement considered.

Author note: The Yale Swallow Protocol presented here is a reproduction of the procedure from the "Bedside Swallow Screen and Aspiration Precautions" policy that is in place within the health system. The Protocol has been modified for the facility's clinical use.

Appendix D

Hospital Developed Swallow Screening Tool

Nursing Swallow Screen

Directions: Complications of aspiration can be prevented by identifying patients who are at risk for aspiration and implementing a plan of care for feeding and medication administration. Conduct a swallow screen on admission or in response to a condition change and document your results below for each screening criteria. **WHEN RESULTS ARE POSITIVE FOR AN ABNORMALITY PLACE THE PATIENT ON NPO STATUS. CONTACT THE MD PROMPTLY AND OBTAIN A M.D. ORDER FOR A SWALLOWING EVALUATION CONSULT BY SPEECH PATHOLOGY.** Formal swallowing evaluations are done by a speech language pathologist only upon written M.D. order.

Screening is performed by a RN and includes the following (circle one either yes or no for each screening criteria result):

SCREENING CRITERIA	RESULT		COMMENTS
Alert	YES	NO	
Follows Commands	YES	NO	
Lip Closure	YES	NO	
Aspiration History	YES*	NO	
Controls Secretions	YES	NO*	
Coughs up Secretions	YES	NO*	
Severe slurred speech	YES*	NO	
If the patient has passed the swallow screen up to this point, give patient a sip of water from a cup (no straws)			
Loss of Liquids Out of Mouth	YES*	NO	
Holding Liquids	YES*	NO	
Coughing post / after swallows	YES*	NO	
Vocal Quality past Swallow	Clear	Gurgling*	

*** = Abnormality - Any screening result marked with an asterisk (*) indicates an abnormality is present.***

Signature / Title nurse completing screen: _____

Date Completed: _____ Time Completed: _____

NURSING SWALLOW SCREEN

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