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ORIGINAL ARTICLE

Answering Orientation Questions and Following Single-Step Verbal Commands: Effect on Aspiration Status

Steven B. Leder · Debra M. Suiter · Heather Lisitano Warner

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Abstract In the acute-care setting patients with altered mental status as a result of such diverse etiologies as stroke, traumatic brain injury, degenerative neurologic impairments, dementia, or alcohol/drug abuse are routinely referred for dysphagia testing. A protocol for dysphagia testing was developed that began with verbal stimuli to determine patient orientation status and ability to follow single-step verbal commands. Although unknown, it would be beneficial to ascertain if this information on mental status was predictive of aspiration risk. The purpose of this investigation was to determine if there was a difference in odds for aspiration based upon correctly answering specific orientation questions, i.e., 1. What is your name? 2. Where are you right now? and 3. What year is it?, and following specific single-step verbal commands, i.e., 1. Open your mouth. 2. Stick out your tongue. and 3. Smile. In a consecutive retrospective manner data from 4070 referred patients accrued between 1 December 1999 and 1 January 2007 were analyzed. The odds of liquid aspiration were 31% greater for patients not oriented to person, place, and time (odds ratio [OR] = 1.305, 95% CI = 1.134–1.501). The odds of liquid aspiration (OR = 1.566, 95% CI = 1.307–1.876), puree aspiration (OR = 1.484, 95% CI = 1.202–1.831), and being deemed unsafe for any oral intake (OR = 1.688, 95% CI = 1.387–2.054) were, respectively, 57, 48, and 69% greater for patients unable to follow single-step verbal commands. Being able to answer orientation questions and follow single-step verbal commands provides information on odds of aspiration for liquid and puree food consistencies as well as overall eating status *prior to dysphagia testing*. Knowledge of potential increased odds of aspiration allows for individualization of dysphagia testing thereby optimizing swallowing success.

Keywords Deglutition · Deglutition disorders · Cognition · Aspiration

The practice of evidence-based medicine integrates individual clinical experience with the best available external clinical evidence from systematic research [1]. Patients with altered mental status are routinely referred for dysphagia testing. These patients have diverse etiologies such as stroke, traumatic brain injury, degenerative neurologic impairments, dementia, or alcohol/drug abuse. Various orientation questions and verbal commands have been used as part of the neurologic and functional assessment of swallowing and a correlation was found between cognitive problems and dysphagia in both stroke patients [2, 3] and adult patients referred for dysphagia testing [4].

A dysphagia evaluation protocol that began with verbal stimuli to determine orientation status and ability to follow single-step verbal commands in order to establish a general

The work for this study was performed at Yale University School of Medicine and The University of Memphis.

S. B. Leder (✉)
Department of Surgery, Section of Otolaryngology, Yale University School of Medicine, P.O. Box 208041, New Haven, CT 06520-8041, USA
e-mail: steven.leder@yale.edu

D. M. Suiter
School of Audiology and Speech-Language Pathology, The University of Memphis, 807 Jefferson Ave., Memphis, TN 38105, USA

H. Lisitano Warner
Speech and Swallow Center, Yale-New Haven Hospital, 20 York St., YPB-468, New Haven, CT 065210-3202, USA

impression of basic cognitive functioning was used. It was not known, however, if this routinely collected information could also contribute to *a priori* knowledge of potential aspiration risk. This is especially important in the acute-care setting since a patient's medical status often changes rapidly, e.g., after antibiotic therapy or adequate hydration, as do their functional skills, e.g., ability and motivation to participate in rehabilitation, and mental status, e.g., improved alertness in recovery after stroke, traumatic brain injury, or alcohol/drug withdrawal [5]. Therefore, the dysphagia specialist can be alerted to a potential change in the odds for aspiration if orientation and/or command-following change from correct to incorrect or vice versa.

It would be of interest to determine and beneficial to know if answering specific orientation questions and following specific single-step verbal commands are predictive of aspiration status *prior to dysphagia testing* using a large and heterogeneous population sample. The purpose of this investigation was to determine the odds for aspiration based upon correctly answering orientation questions, i.e., 1. What is your name? 2. Where are you right now? and 3. What year is it?, and following single-step verbal commands, i.e., 1. Open your mouth. 2. Stick out your tongue. and 3. Smile.

Methods

Subjects

This study was approved by the Human Investigation Committee, Yale University School of Medicine. Table 1 gives participant demographics, Table 2 gives participant diagnostic categories, and Fig. 1 shows the number of participants by age.

All subjects were referred by their physician for dysphagia testing. Inclusion criteria were 10 years of age or older and based on specific minimum levels from two subscales of the Comprehensive Level of Consciousness Scale [6]. This scale provided detailed reliable information for the assessment of acute and severe impairments of neurologic functioning. General Responsiveness (Scale 7 #8) was defined as the person is fully aroused and alert or, if asleep, arouses and attends to the examiner following only mild or moderate stimulation. The arousal outlasts the duration of the stimulus. Best communicative effort (Scale 8 #3) was defined as the person visually tracks an object passed through his/her visual field and/or turns his/her head toward the examiner as if wishing to communicate or the patient generates spontaneous moaning or muttering with reliable eye contact or searching behaviors.

Table 1 Participant demographic information

Gender[a]	Males	Females
	$N = 2296$ (56.6%)	$N = 1766$ (43.4%)
Age[b] (years)	66.5	70.4
	(range = 10.0–105.0)	(range = 11.0–105.0)

[a] Missing data for 8 (0.1%) participants

[b] Missing data for 20 (0.5%) participants

Table 2 Participant diagnostic categorie

Diagnostic category	*N*
Cardiothoracic surgery	214
Esophageal surgery	77
Head and Neck surgery	171
Neurosurgery	313
Medical	798
Pulmonary	641
Cancer	168
Other medical	412
Left stroke	300
Right stroke	261
Brainstem stroke	54
Parkinson's disease	30
Dementia	127
Other neurologic	487
Total	4053[a]

[a] Missing data for 17 (0.4%) of participants

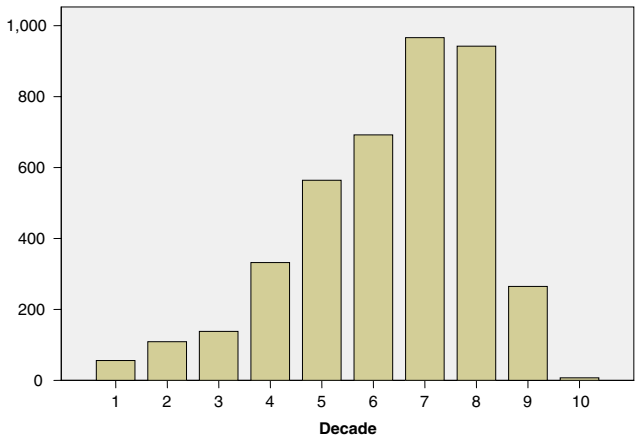

Fig. 1 Participants by age

Procedures

Prior to dysphagia testing, each participant was asked: 1. What is your name? 2. Where are you right now? and 3. What year is it? Each participant was then given the verbal commands 1. Open your mouth. 2. Stick out your tongue. and 3. Smile. The criteria required that all three orientation questions and all three commands had to be correct.

Stimuli were given orally in English or Spanish as appropriate.

Fiberoptic endoscopic evaluation of swallowing (FEES) is now a standard of care, with recent research demonstrating that FEES has equal or greater sensitivity in the detection of laryngeal penetration and tracheal aspiration when compared with videofluoroscopic evaluation of swallowing [7, 8]. The standard FEES protocol [9, 10] was followed with slight modifications, e.g., testing was not recorded. Briefly, each naris was examined visually and the scope passed through the most patent naris without administration of a topical anesthetic or vasoconstrictor to the nasal mucosa, thereby eliminating any potential adverse anesthetic reaction and assuring the endoscopist of a safe physiologic examination [11]. The base of tongue, pharynx, and larynx were viewed and swallowing was evaluated directly with six food boluses of approximately 5 ml (range = ± 3–8 ml) each. All patients were fed and allowed to swallow spontaneously, i.e., without a verbal command to swallow [12]. FEES equipment consisted of a 3.6-mm-diameter flexible fiberoptic rhinolaryngoscope (Olympus, ENF-P3), light source (Olympus, CLK-4), camera (ELMO, MN401E), and color monitor (Magnavox, RJ4049WA01).

The first food challenge consisted of three boluses of puree consistency (yellow pudding) followed by three thin-liquid boluses (white milk) because these colors have excellent contrast with pharyngeal and laryngeal mucosa [13]. Aspiration was defined as entry of material into the airway below the level of the true vocal folds [14]. A safe swallow was defined as no aspiration and an unsafe swallow was defined as aspiration of both liquid and puree consistencies during FEES.

After FEES testing was completed and aspiration status recorded for both thin-liquid and puree consistencies, patients who aspirated thin liquids but swallowed puree consistency successfully were given a trial of thickened liquids. This was done to determine an optimal oral diet because all subjects were also referred patients for dysphagia testing. Some of these individuals were deemed safe for a modified diet consisting of thickened (but not thin) liquids. Since not all subjects received thickened liquids, aspiration status with this consistency was not included in the data analysis.

The endoscopist (SBL) who performed all FEES ratings in the present study recently participated in an investigation that determined intrarater reliability with FEES using non-blue-dyed food trials [13]. Intrarater agreement on 66 trials was 100% for tracheal aspiration.

Statistical Analysis

FEES outcomes were the criterion reference to which orientation and command-following were compared. Two-by-two contingency tables were developed to compare rates of thin-liquid aspiration, puree aspiration, and safe or unsafe swallowing relative to orientation status and command-following ability. Because of the retrospective nature of the study design, Pearson's χ^2 tests and odds ratios (OR) were then computed to determine odds for increased aspiration. The OR is a measure of effect size and is defined as the ratio of the odds of an event occurring in one group compared to the odds of the same event occurring in another group. The OR must be greater than or equal to zero, and an OR greater than 1.00 indicates that the event under study is more likely to occur in that particular group. Confidence intervals for odds ratios were computed by a general method based on constant χ^2 boundaries [15].

Results

Orientation Status

Table 3 gives the results of liquid aspiration, puree aspiration, and safety for any type of oral intake based upon orientation status.

Orientation—thin liquids A total of 2217 of 4070 (54.4%) participants were oriented to person, place, and time. Five hundred twenty-six of 2217 (23.7%) aspirated thin liquids during instrumental assessment and 1691 (76.3%) did not. A total of 1853 of 4070 (45.6%) participants were not oriented and 535 of them (29.0%) aspirated thin liquids during instrumental assessment and 1318 (71.0%) did not. Pearson's χ^2 results revealed a significant association between orientation and aspiration status (χ^2 [1, $N = 4070$] = 13.871, $p \leq 0.001$). The odds of liquid

Table 3 Results of χ^2 for liquid aspiration, puree aspiration, and safety for any type of oral intake based upon orientation status

Aspiration status	Orientation to person, place, and time		Total
	Yes (%)	No (%)	
Liquid aspiration[a]			
Yes	526 (23.7)	535 (29.0)	1061
No	1691 (76.3)	1318 (71.0)	3009
Total	2217	1853	4070
Puree aspiration			
Yes	347 (15.7)	315 (17.0)	662
No	1870 (84.3)	1538 (83.0)	3408
Total	2217	1853	4070
Safe for oral intake			
Yes	1827 (82.4)	1481 (79.9)	3308
No	390 (17.6)	372 (20.1)	762
Total	2217	1853	4070

[a] $p < 0.001$

aspiration were 31% greater for individuals not oriented to person, place, and time than for individuals who were oriented (OR = 1.305, 95% CI = 1.134–1.501).

Orientation—puree Three hundred forty-seven of 2217 (15.7%) participants who were oriented to person, place, and time aspirated puree during instrumental assessment and 1870 (84.3%) did not. Three hundred fifteen of 1853 (17.0%) participants who were not oriented aspirated puree during instrumental assessment and 1538 (83.0%) did not. Pearson's χ^2 results were nonsignificant ($p > 0.05$). The odds of puree aspiration was not greater for individuals who were not oriented than for those who were (OR = 1.104, 95% CI = 0.935–1.305).

Orientation—oral intake A total of 390 of 2217 (17.6%) participants who were oriented to person, place, and time were deemed unsafe for oral intake, and a total of 372 of 1853 (20.1%) participants who were not oriented were deemed unsafe for oral intake. Pearson's χ^2 results were nonsignificant ($p < 0.05$). The odds of being deemed potentially unsafe for any oral intake were not greater based on orientation status (OR = 1.177, 95% CI = 1.005–1.378).

Command-Following

Table 4 gives the results of liquid aspiration, puree aspiration, and safety for any type of oral intake based on ability to follow single-step verbal commands.

Command-following—thin liquids A total of 3418 of 4066 (84.0%) participants were able to follow one-step commands. Eight hundred forty-two of 3418 (24.6%) aspirated thin liquids during instrumental assessment and 2576 (75.4%) did not. A total of 648 of 4066 (16.0%) participants were unable to follow commands, and 219 (33.8%) aspirated thin liquids during instrumental assessment and 429 (66.2%) did not. Pearson's χ^2 analysis revealed a significant association between the ability to follow commands and liquid aspiration status (χ^2 [1, $N = 4066$] = 23.989, $p \leq 0.001$). The odds of liquid aspiration were 57% greater for participants who were unable to follow single commands than for those able to follow single commands (OR = 1.566, 95% CI = 1.307–1.876).

Command-following—puree Five hundred twenty-five of 3418 (15.4%) participants who were able to follow commands aspirated puree during instrumental assessment and 2893 (84.6%) did not. One hundred thirty-eight of 648 (21.2%) participants who were unable to follow commands aspirated puree during instrumental assessment and 510 (78.8%) did not. Pearson's χ^2 analysis revealed a significant relationship between command-following ability and puree aspiration status (χ^2 [1, $N = 4066$] = 13.649, $p \leq 0.001$). The odds of puree aspiration were 48% greater for participants who were unable to follow single commands than for those able to follow single commands (OR = 1.484, 95% CI = 1.202–1.831).

Command-following—oral intake Five hundred ninety-three of 3418 (17.3%) participants who were able to follow commands were deemed unsafe for oral intake, and 170 of 648 (26.2%) participants who were unable to follow commands were deemed unsafe for oral intake. Pearson's χ^2 analysis revealed a significant association between command-following ability and oral intake status (χ^2 [1, $N = 4066$] = 27.691, $p \leq 0.001$). The odds of being deemed unsafe for any oral intake were 69% greater for participants who were unable to follow single commands than for those able to follow single commands (OR = 1.688, 95% CI = 1.387–2.054).

Table 4 Results of χ^2 for liquid aspiration, puree aspiration, and safety for any type of oral intake based upon ability to follow single-step verbal commands

Aspiration status	Follow single-step verbal commands		Total
	Yes (%)	No (%)	
Liquid aspiration[a]			
Yes	842 (24.6)	219 (33.8)	1061
No	2576 (75.4)	429 (66.2)	3005
Total	3418	648	4066[b]
Puree aspiration[a]			
Yes	525 (15.4)	138 (21.2)	670
No	2893 (84.6)	510 (78.8)	3427
Total	3418	648	4066[b]
Safe for oral intake[a]			
Yes	2825 (82.7)	478 (73.8)	3303
No	593 (17.3)	170 (26.2)	763
Total	3418	648	4066[b]

[a] $p < 0.001$

[b] Missing data for four (0.1%) participants

Discussion

It is advantageous to test for orientation and command-following *prior to dysphagia testing*. This quick-and-easy assessment provides valuable clinical information on the odds of aspiration for the upcoming dysphagia evaluation. Specifically, knowledge of this information informs the clinician that if the patient is not oriented to person, place, and time then the potential odds of aspiration with thin liquids are 31% greater than if oriented. Similarly, if the patient cannot follow commands the clinician should be aware that the odds of aspiration with both thin liquids and puree as well as the potential of being deemed unsafe for

any type of oral intake are 57, 48, and 69%, respectively, greater than if command-following is successful.

Knowledge of potential increased odds of aspiration prior to dysphagia testing is of direct clinical benefit. The clinical importance of research findings are based on how data are used in the clinical setting. The fact that a given patient cannot answer orientation questions or follow single-step verbal commands should alert the clinician to potential increased odds of aspiration risk. It does not mean that testing should be deferred or that thin liquids should not be used, but rather extra care should be taken to ensure the most clinically useful test in order to promote resumption of oral alimentation. For example, bolus volume modifications can be made at time of testing to reduce the odds for aspiration and having nectar- and honey-thick liquids prepared and available streamlines the testing process. This is exemplified in Tables 3 and 4 as patients who aspirated thin liquids but swallowed puree consistency successfully were given a trial with thickened liquids which often resulted in a successful swallow and being deemed safe for a modified diet consisting of thickened liquids and puree consistencies.

There is no universally accepted standard dysphagia evaluation protocol. Although clinicians may be using other questions and commands [2, 3], the systematically investigated exemplars used in the present study satisfy the requirements of evidence-based medicine [1] and can be used confidently by dysphagia specialists to determine odds for potential aspiration. In addition, more patients aspirated thin liquids than puree consistencies in the present study. This finding corroborates earlier reports of increased frequency of thin-liquid aspiration during dysphagia testing [16, 17]. Therefore, if orientation and command-following are impaired, the clinician should be aware that the potential odds of liquid aspiration for that particular patient are greater than if orientation and command-following are correct. In this case, a dysphagia testing protocol that starts with thin liquids should be modified to begin with puree consistency which has the potential to be swallowed more successfully. All of the above efforts are implemented on an individual patient basis to reduce the odds of aspiration in order to achieve the most beneficial swallowing assessment.

Study Strengths, Limitations, and Future Research

This study's major strength was the use of a large and heterogeneous population sample allowing for adequate statistical power to answer confidently the research question. Other strengths that increased generalizability of results included a wide variety of diagnostic categories, consecutive subject accrual, equivalent gender distribution, and spanning of the age spectrum. Limitations of this study were use of a referred population sample versus a randomized controlled research design and inter-rater reliability could not be determined since only one experienced endoscopist (albeit with documented very high intrarater agreement) determined aspiration status. Future research should investigate other verbal stimuli that may predict aspiration status and incidence of aspiration with dysphagia protocols that use different food consistency presentation orders.

Conclusion

The more knowledge a clinician has prior to dysphagia testing the better patient care will be. Extra care can then be taken for those patients where *a priori* knowledge of potential dysphagia due to increased odds of aspiration of thin-liquid and/or puree food consistencies are known. Use of simple orientation questions and single-step verbal command-following to ascertain potential increased odds of both aspiration and safe oral intake *prior to dysphagia testing* allows for a more precise dysphagia evaluation, e.g., by limiting bolus volume, starting with puree versus thin-liquid consistency, and knowing that thickened liquids may be needed. This permits more focused testing, a more accurate diagnosis, and individualized recommendations for intervention all done in an effort to promote safe oral alimentation.

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Steven B. Leder PhD, CCC-SLP

Debra M. Suiter PhD, CCC-SLP

Heather Lisitano Warner MA, CCC-SLP