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Diagnosis and treatment of post-extubation dysphagia: Results from a National Survey

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Abstract

Purpose—This study sought to determine the utilization of speech-language pathologist (SLPs) for the diagnosis and treatment of post-extubation dysphagia in survivors of mechanical ventilation.

Methods—We designed, validated, and mailed a survey to 1,966 inpatient SLPs who routinely evaluate patients for post-extubation dysphagia.

Results—The majority of SLP diagnostic evaluations (60%; 95% CI = 59–62%) were performed using clinical techniques with uncertain accuracy. Instrumental diagnostic tests (such as fluoroscopy and endoscopy) are more likely to be available at university than community hospitals. After adjusting for hospital size and academic affiliation, instrumental test use varied significantly by geographical region. Treatments for post-extubation dysphagia usually involved dietary adjustment (76%; 95% CI = 73–79%) and postural changes/compensatory maneuvers (86%; 95% CI = 84–88%), rather than on interventions aimed to improve swallowing function (24%; 95% CI = 21–27%).

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Competing Interests

The authors declare that they have no competing interests.

Authors' contributions

M. Macht and M. Moss conceived of the study and contributed to the data analysis, and manuscript preparation. M. Macht also contributed to the data collection. TW participated in the study design and also contributed to the data collection. BJC, ABB, and ELB contributed to the study design, analysis, and manuscript preparation. AW contributed to the statistical analysis and manuscript preparation. All authors read and approved the final manuscript.

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Conclusions—SLPs frequently evaluate acute respiratory failure survivors. However, diagnostic evaluations rely mainly upon bedside techniques with uncertain accuracy. The use of instrumental tests varies by geographic location and university affiliation. Current diagnostic practices and feeding decisions for critically ill patients should be viewed with caution until further studies determine the accuracy of bedside detection methods.

Keywords

Mechanical Ventilation; Intratracheal Intubation; Respiratory Aspiration; Dysphagia; Swallowing Disorders

Introduction

There are approximately 220,000 survivors of acute respiratory failure requiring mechanical ventilation each year in the United States [1,2]. These patients have a median survival of more than 5 years, yet commonly suffer from long-term neuromuscular, psychiatric, cognitive, and pulmonary disorders that are associated with poorer functional status, decreased quality-of-life, and increased caregiver burden [3–7]. Recently, attention has focused on the epidemiology, mechanisms, and adverse effects of laryngeal, swallowing, and voice disorders in these patients [8,9]. Post-extubation dysphagia, defined as the inability to effectively transfer food from the mouth into the stomach, is estimated to affect a minimum of 20% of all survivors of acute respiratory failure who required endotracheal intubation [8], and is independently associated with both prolonged hospital length of stay after extubation, and the composite of hospital-acquired pneumonia, reintubation, and mortality [10]. Endotracheal tubes can cause dysphagia via mucosal abrasions, supra-glottic edema, or decreased laryngeal sensation, whereas critical illness alone is thought to contribute to this disorder by damaging peripheral and bulbar nerves and muscles, altering cognition, and causing dysregulation of the swallowing reflex [11]. Based on national estimates, the yearly cost of dysphagia in hospitalized patients is over \$500 million [12], and 44,000 patients will suffer from dysphagia following critical illness [1,2,8].

Speech-language pathology is an expanding, nationally-accredited discipline with over 150,000 professionals in the United States that focuses on the diagnosis and treatment of swallowing and communication disorders [13]. Speech-language pathologists (SLPs) currently devote 56% of their inpatient efforts to the evaluation and treatment of dysphagia, representing a 19% increase over the past 9 years [14]. After evaluating for dysphagia, SLPs usually interact with other rehabilitation specialists and physicians to develop treatment strategies. Various tests are available to diagnose post-extubation dysphagia, including bedside evaluations during which SLPs observe patients during routine swallowing, and instrumental tests such as a videofluoroscopic swallow study (VFSS) and a Fiberoptic Endoscopic Evaluation of Swallowing (FEES). Currently, despite increased SLP utilization, there is a limited understanding of the current diagnostic and therapeutic practices of SLPs for patients in the United States recovering from mechanical ventilation.

Therefore, we conducted a national survey of SLPs to elucidate their current practices for the evaluation of post-extubation dysphagia in these patients, including hospital staffing patterns, the availability and utilization of diagnostic procedures, and the frequency and perceived effectiveness of different treatment strategies. Our goal was to determine the current practice patterns for this disease in order to both guide subsequent research studies and to form a basis for future nationwide diagnostic and management standards. We also aimed to assess SLP opinions regarding the potential mechanisms for the development of post-extubation dysphagia.

Materials and Methods

Study participants

We mailed a self-administered survey to certified SLPs in the United States who both evaluate patients for swallowing dysfunction and care for those who have received mechanical ventilation. Participants were identified using a database from the American Speech-Language-Hearing Association (ASHA), a professional organization with approximately 150,000 members. We obtained a list of the 1,966 certified SLPs (95% were female) who were both members of the dysphagia special interest division (SID 13), and employed in a general medical hospital (including Veteran's Affairs hospitals). We mailed the survey between September-November 2010.

Survey development

Questions and brief scenarios were developed through an iterative process involving SLPs and critical care physicians at our institution. First, we implemented a series of five conferences with SLPs to identify common questions related to the diagnosis and treatment of post-extubation dysphagia. After these conferences, we generated individual questionnaire items. We initially constructed a 36-item questionnaire that was reviewed by a group of three SLPs, each with over 10 years of dysphagia experience, for clarity and content validity. We modified the questionnaire based on the results of this pre-testing, and the revised 34-item instrument was then pilot tested among a larger group of SLPs to assess for both inter-rater and test/re-test reliability. We defined a bedside swallow evaluation (BSE) as any combination of questions and non-instrumented, minimally-invasive tests performed at the bedside to elicit the signs of aspiration [15]. A videofluoroscopic swallow study (VFSS, or "modified barium swallow") was defined as the successive administration of a combination of foods and liquids containing barium with subsequent fluoroscopic imaging of the swallowing reflex with the intent of directly visualizing the presence or absence of aspiration [16]. We defined a fiberoptic endoscopic evaluation of swallowing (FEES) as previously described by Langmore, Schatz and Olson [17,18].

Survey content

The final 34-item questionnaire required about 15 minutes to complete and included questions regarding demographics, diagnostic evaluations, treatments, and perceptions about post-extubation dysphagia risk factors. Questions about diagnostic evaluations sought to determine: the mechanisms for SLP involvement; the existence of established hospital guidelines and/or screening protocols; the timing of SLP evaluations post-extubation; the frequency of use for 21 different components of the BSE; and the indications, availability, and frequency of use for several instrumental diagnostic tests (including the VFSS and FEES). Frequency was assessed with a five-point Likert scale from 1 (never) to 5 (always). The frequency of different treatments was assessed with the same five-point Likert scale. The perceived effectiveness of each treatment was then assessed with a five-point Likert scale from 1 (not effective) to 5 (very effective). We also asked SLPs to report their perceptions regarding two common clinical questions: 1) the effect of the duration of intubation on dysphagia; and 2) the effect of nasogastric feeding tubes on the presence of dysphagia. For intubation duration questions, SLPs were asked to rate their opinion regarding the likelihood of developing dysphagia for patients intubated for two, or seven days, on a 10-point Likert scale from 1 (very unlikely) to 10 (very likely). For feeding tube questions, SLPs were asked to report their opinion regarding how often both large and small-bore nasogastric tube contribute to dysphagia on a 10-point Likert scale from 1 (rarely) to 10 (frequently).

Survey administration

We mailed the survey with a pre-stamped envelope. All SLPs received a reminder postcard approximately 6 weeks after the first mailing. After another 4 weeks, all SLPs were sent a second survey and a reminder letter. Our letter asked that respondents not complete the survey a second time. The survey was completed anonymously. None of the respondents were compensated for their involvement and all responses were voluntary. The Colorado Multiple Institutional Review Board approved the study protocol.

Statistical analysis

Upon receipt, the results of each survey were entered into a database for analysis (SAS software, version 9.1, Cary, NC, USA). We performed descriptive analyses of measured variables using means and standard deviations or medians with interquartile ranges as appropriate. Univariate comparisons were evaluated with chi-square, Wilcoxon rank-sum, or Kruskal-Wallis tests, as appropriate. To evaluate the reliability of multiple component questions 23 and 24, Cronbach's alpha was calculated. Backward logistic regression models were used to determine the effect of geographic region on the frequency of use of different diagnostic tests, where geographic region was defined by state as either northeast, southeast, midwest, southwest, or west [19]. Nonparametric tests were used when data was not normally distributed. Statistical significance was defined as $p < 0.05$. Frequency of use for both diagnostic tests and treatments is reported as either the mean value of the five-point Likert scale, or as the percentage of respondents reporting "usually" or "always" using each component, as indicated. As reported in previous surveys, agreement between respondents was defined as the percentage of responses in the most common category, ranging from 20% (responses equally split between the five categories) to 100% (complete agreement on one category) [20].

Results

Demographics

A total of 836 SLPs representing hospitals from all 50 states responded to the survey (overall response rate of 43%). A total of 35 respondents returned but did not complete the survey because they no longer worked in a critical care setting. Therefore, the responses from 801 SLPs were included in the final analysis. Self reported characteristics of respondents are listed in Table 1. The majority of respondents practiced in an acute care hospital (56%) followed by a hospital with a mixture of acute care and rehabilitation (39%). A total of 75% (600/801) of the respondents worked in hospitals without any university affiliation, while the remaining 25% (199/801) worked in either university or university-affiliated hospitals. Hospitals of primary employment were of varying sizes: 39% were <250 beds, while 30% were 250–400 beds, 22% were 401–700 beds, and 9% were >700 beds. Cronbach's alpha coefficient was 0.71 for question 23 (frequency of use for diagnostic components), and 0.78 for question 24 (frequency of use for treatments).

Staffing patterns

Cases involving the evaluation and management of dysphagia represented a median of 80% [70–90%] of respondents' total caseloads. Of all the dysphagia evaluations done, 25% [10–50%] were performed on patients who had received mechanical ventilation during their hospital admission. SLPs practicing in hospitals affiliated with a university reported performing a higher median percentage of their total BSEs on recently extubated patients (35% vs 20%, $p < 0.001$). Only two of the 801 respondents reported caring exclusively for ICU patients, while the remainder cared for patients in all parts of the hospital.

Involvement of SLPs after extubation and use of the bedside swallow evaluation

Most respondents (90%; 95% CI = 88–92%) required a request from the treating physician in order to become involved with the care of recently extubated patients. An additional 3% (95% CI = 1.9–4.3%) of SLPs reported that they automatically care for *all* recently extubated patients. Guidelines to assist a physician in determining whether to consult a SLP were present in 29% (95% CI = 25–32%) of all hospitals. Hospitals with established physician guidelines tended to have more than 400 beds (37% vs 24%, $p < 0.001$), and to be affiliated with a university (34% vs 27%, $p < 0.04$). Bedside screening protocols (such as a 3 oz. water-swallow test) were used by 41% (330/801) of hospitals. These screening protocols were most often administered by nursing staff (66%), followed by SLPs (27%), a combination of nurses/SLPs (3%), or physicians (1%). When consulted, SLPs reported waiting a median of 24 hours [18–24 hours] after extubation before performing a BSE. The majority of diagnostic evaluations (60%; 95% CI = 59–62%) were performed using only a BSE. The frequency of use and agreement between responses for the different components of the BSE are listed in Table 2.

Instrumental diagnostic procedures

A videofluoroscopic swallow study (VFSS) was the most widely available diagnostic test (98%), followed by a fiberoptic endoscopic evaluation of swallowing (FEES) (41%), ultrasonography (12%), manometry (12%), surface electromyography (7%), and scintigraphy (6%). Both VFSS and FEES, considered to be gold standard tests for the diagnosis of dysphagia, were significantly more likely to be available at university than community hospitals (100% vs 97%, $p < 0.01$; 69% vs 32%, $p < 0.01$, respectively) (Table 3). Reported criteria for obtaining a VFSS included an uncertain diagnosis after bedside exam (99% of respondents), suspicion for silent aspiration (96%), evaluating a treatment strategy (76%), or recurrent pneumonia (7%). Thirty-five percent (278/800) of all respondents added additional indications for obtaining a VFSS, including but not limited to: the presence of a tracheostomy, right-lower-lobe pneumonia, laryngeal cancer, or spinal cord injury.

Respondents reported using a VFSS to diagnose post-extubation dysphagia in $40 \pm 22\%$ of patients. For those SLPs who worked in facilities where VFSS was available ($n=794$) VFSS was used “usually or always” by 32% of respondents and “seldom or never” in 20%. The frequency of VFSS use was not associated with the availability of FEES. As shown in Table 3, when analyzing only those respondents working in hospitals in which FEES was available ($n=319$), FEES was used infrequently in both university and community hospitals (15% vs 8%, $p=0.06$). Both VFSS and FEES use varied significantly by geographical region (Fig. 1–2). In multivariate analysis done to adjust for hospital size and academic affiliation, the geographic differences in VFSS and FEES use remained significant ($p < 0.01$ for both comparisons).

Fifty-three percent of SLPs reported that they were qualified to administer a VFSS independently. Eighty-six percent of SLPs reported having primary responsibility of interpreting the results of a VFSS, as opposed to 14% who reported that a radiologist has the primary responsibility. More SLPs at university hospitals reported being qualified to administer a VFSS (60% vs 50%, $p=0.02$). Neither the qualification to perform, nor to interpret the VFSS, was significantly associated with increased VFSS use. In those hospitals where FEES was available, FEES was most often performed independently by SLPs (83% of the time).

Treatment of post-extubation dysphagia

The frequency of use and the perceived effectiveness for different treatments of post-extubation dysphagia, are shown in Table 4. Treatments for post-extubation dysphagia were usually focused on dietary texture modifications (76%; 95% CI = 73–79%) and postural changes/compensatory maneuvers (86%; 95% CI = 84–88%), rather than on interventions aimed to improve swallowing function (24%; 95% CI = 21–27%). Respondents also reported testing treatment strategies during the VFSS in 80% [50–95%] of cases. When measuring respondents' agreement, based on the percentage of responses in the most common category (ranging from 20% if responses were equally split between the five categories to 100% if all responses belonged to one category), no treatment of post-extubation dysphagia achieved greater than 75% agreement.

Opinions on the effect of intubation duration

Using a Likert scale from 1 (very unlikely to have post-extubation dysphagia) to 10 (very likely to have post-extubation dysphagia), patients with prolonged mechanical ventilation (7 days) were reported to have a higher mean score than patients with brief mechanical ventilation (2 days) (7.7 ± 1.7 vs 4.3 ± 1.8 , $p < 0.01$). SLPs employed in a community hospital estimated that post-extubation dysphagia was more likely to be present after both prolonged (7.9 ± 1.7 vs 7.4 ± 1.8 , $p = 0.01$), and brief mechanical ventilation (4.5 ± 1.9 vs 3.9 ± 1.9 , $p < 0.01$) when compared to SLPs employed in a university setting.

Opinions on the effect of nasogastric feeding tubes

Using a Likert scale from 1 (rarely contributes to post-extubation dysphagia) to 10 (frequently contributes to post-extubation dysphagia), patients with a large-bore nasogastric tube were reported to have a mean score of 6.5 ± 2.3 , while patients with a small-bore tube were reported to have a mean score of only 3.8 ± 2.0 . SLPs employed in a community hospital estimated that post-extubation dysphagia was more likely to be present after Dobhoff tube placement (4.0 ± 2.1 vs 3.4 ± 1.9 , $p < 0.01$) when compared to SLPs employed in a university setting.

Discussion

This survey is the first to review existing practice patterns in the United States for the diagnosis and treatment of dysphagia in recently extubated critically ill patients. The decision to consult SLPs is made primarily by the treating physician, while nurses are frequently involved in post-extubation dysphagia screening. For the majority of patients, non-invasive bedside maneuvers with uncertain diagnostic accuracy are used to estimate the presence and severity of post-extubation dysphagia, and SLPs report varying preferences with regard to the bedside maneuvers they use most frequently. When necessary, additional diagnostic tests such as VFSS and FEES are usually performed independently by SLPs. These tests are more likely to be available at university than community hospitals, and are used with different frequencies in different geographic regions. SLPs employed in community hospitals are also more likely to predict that post-extubation dysphagia would be present in a variety of clinical scenarios. These differences in estimated pretest probability could affect the estimated prevalence of post-extubation dysphagia among different institutions. Current post-extubation dysphagia interventions are food thickness alteration, postural change, compensatory maneuver training, and therapeutic exercises. Importantly, these treatments have limited proven benefit in this disease, and the exact mechanisms for the development of post-extubation dysphagia are unclear.

Small groups of both North American and European SLPs have been surveyed in the past regarding outpatient dysphagia assessment practices [20–22]. McCullough and colleagues

surveyed 61 SLPs with an identified interest in dysphagia and found wide variation regarding the perceived bedside and videofluoroscopic methods that should be used to assess for dysphagia in a non-ICU population [22]. Mathers-Schmidt and Kurlinski surveyed 150 SLPs in Western Washington State and also demonstrated a wide variation with regard to clinical decision making in six different patient-based scenarios [21]. These data are consistent with the poor inter- and intra-reliability of the BSE in patients suffering from an acute stroke [23]. While the operating characteristics of the BSE have not been studied in recently-extubated survivors of critical illness, several studies of other patient groups have suggested limited diagnostic accuracy when compared to gold standard tests [15,24–26].

Dysphagia treatment modalities have been relatively under-explored, especially in those patients recovering from acute respiratory failure. Based on limited evidence, previous reports have suggested dietary modification, postural change, or enteral feeding as methods to avoid persistent aspiration in noncritically ill patients with chronic neuromuscular disease [27,28]. Since the more recent publication of a series of literature reviews outlining the need for prospective studies of dysphagia treatment [29–31], one multi-center trial of 321 patients with an acute stroke randomized to percutaneous endoscopic gastrostomy (PEG) or nasogastric feeding demonstrated an increased risk of death or poor outcome in the PEG group [32]. Another prospective, randomized study of 515 patients with either dementia or Parkinson's disease and videofluoroscopically-confirmed aspiration did not show a difference in the primary outcome of pneumonia at 3 months between those treated with chin-down posture, nectar-thickened liquids, or honey-thickened liquids [33]. More recently, preliminary evidence suggests a benefit in outpatients with direct treatment modalities such as neuromuscular electrical stimulation, cricopharyngeal botulinum toxin injection, and surface electromyography biofeedback that aim to alleviate the underlying neuromuscular disorder in dysphagia [34–36]. Our results show that SLPs have varying opinions regarding the frequency and effectiveness of currently used treatments for post-extubation dysphagia.

Our study has several limitations. First, the response rate to our questionnaire was 43%. While this response rate is within the range of other recently published surveys of critical care professionals [37–40], our study could certainly be limited by sampling bias. Regarding the potential for sampling bias, the large proportion of female questionnaire-recipients (95%), and respondents (94%), is consistent with existing data showing that 96% of United States SLPs are female [14]. Despite these data, it is still possible that important groups of SLPs were underrepresented in our biased sample, and that the nonresponse bias led to skewed results. As we have no data from nonrespondents, the reasons for non-response are uncertain. Second, the opinions of SLPs regarding the effect of intubation duration and enteral feeding tubes on swallowing function is at least partly subjective. We included these questions and answers to shed light on the current state of the field and to guide further research studies, rather than to serve as definitive explanations of the pathophysiology of this disorder. Third, we did not ask the opinions of other healthcare professionals, such as critical care nurses, respiratory therapists, occupational therapists, physical therapists, and critical care physicians. It is possible that other non-SLP professionals perform other diagnostic or therapeutic techniques pertinent to the evaluation and management of post-extubation dysphagia. Based on our results revealing nurses' common involvement in the screening for post-extubation dysphagia, a subsequent survey of critical care nurses may be important to more thoroughly understand the management of this disease. Fourth, although previous surveys of SLPs have included measurements of response agreement [20], it is not clear that this method is the most ideal for addressing practice variation. Finally, our survey did not address precisely how physicians, using the results of SLP diagnostic procedures, make clinical decisions regarding diet and nutrition for recently-extubated patients.

Future research efforts should evaluate the diagnostic accuracy of current SLP directed testing for post-extubation dysphagia. Additionally, qualitative studies might be necessary to identify the specific barriers faced by SLPs in the evaluation and care of post-extubation patients. Furthermore, epidemiologic studies should determine the precise frequency of post-extubation dysphagia among different patient populations, while prospectively determining the effect of dysphagia on long-term outcomes. Additionally, we speculate that the development of a cost-effective approach for dysphagia screening, and the establishment of effective treatments, could diminish the burden of this disease. Importantly, the specific oral, laryngeal, and pharyngeal abnormalities that develop as a result of critical illness and mechanical ventilation, and the mechanisms by which these abnormalities result in dysphagia and aspiration, are incompletely understood. Therefore, further investigation into these mechanisms might lead to novel diagnostic and therapeutic approaches.

Conclusion

We identified United States speech-language-pathologists' practice patterns for the evaluation and treatment of post-extubation dysphagia. Diagnostic evaluations were performed 60% of the time using bedside strategies that have uncertain diagnostic accuracy, rather than gold-standard instrumental tests. Combined with previously reported evidence that swallowing evaluations have increased by 19% in the last 9 years [14], our data indicate that evaluations for post-extubation dysphagia are common and increasing, despite the lack of a validated diagnostic approach. Patients are managed differently depending on geographic location and university affiliation, and pretest probability variations between SLPs could affect the estimated prevalence of post-extubation dysphagia among different institutions. We also demonstrated that current therapies focus on dietary adjustments, postural changes, and compensatory maneuvers that have limited proven benefits. Therapeutic exercises and neuromuscular stimulation are used infrequently. The establishment of more formal diagnostic standards, the elucidation of the precise underlying mechanisms of this disorder, and the development of novel, effective treatments for those most at-risk could be expected to reduce the burden of this disease. In the meantime, current diagnostic practices and feeding decisions for critically ill patients should be viewed with caution until further studies determine the accuracy of bedside detection methods.

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List of Abbreviations

ASHA	American Speech-Language-Hearing Association
BSE	bedside swallow evaluation
CI	confidence interval
FEES	Fiberoptic Endoscopic Evaluation of Swallowing
ICU	intensive care unit

post-extubation dysphagia	post-extubation dysphagia
SLPs	Speech-language pathologists
VFSS	videofluoroscopic swallow studies

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Figure 1. Geographic variation for the use of a videofluoroscopic swallow study (VFSS) to diagnose post-extubation dysphagia

Percentages indicate those respondents who reported using VFSS “usually or always” ($p < 0.01$). Alaska and Hawaii (not pictured) were included in the West region

Figure 2. Geographic variation for the use of a fiberoptic endoscopic swallow study (FEES) to diagnose post-extubation dysphagia
Percentages indicate those respondents who reported using FEES “half the time” or greater ($p < 0.01$). Alaska and Hawaii (not pictured) were included in the West region

Table 1

Self-reported characteristics of survey respondents. Values are presented as mean $\pm$ standard deviation, median [IQR], or frequency (percent) unless as indicated.

Variable	Respondents (n = 801)
Age	42 $\pm$ 11
Female gender	756 (94)
Years practicing	13 [7–22]
Dysphagia caseload (%)	80 [70–90]
Portion of total BSEs for patients who have had MV (%)	25 [10–50]
Age of patients (%)	
Children (0–11 years)	0 [0–5]
Adolescents (12–17 years)	0 [0–2]
Adults (18–65 years)	30 [20–45]
Seniors (>65 years)	60 [45–70]
Hospital acuity type	
Acute care	451 (56)
Mixture acute/rehabilitation	314 (39)
Rehabilitation	26 (3)
Other	9 (1)
Hospital academic affiliation	
Community	600 (75)
University affiliation	132 (17)
University	67 (8)
Hospital size (number of beds)	
<250	311 (39)
250 to 400	237 (30)
401 to 700	174 (22)
>700	74 (9)
ICU size (number of beds)	
<9	123 (15)
10 to 30	375 (47)
31 to 49	153 (19)
>50	144 (18)
SLPs in hospital -- no.	2.5 [1–4]
SLPs in ICU -- no.	
Zero	38 (5)
1 to 2	551 (69)
3 to 4	125 (16)
>4	78 (10)
Weekend SLP availability	

Variable	Respondents (n = 801)
In hospital both days	431 (54)
Only on call	231 (29)
Not available	135 (17)

Table 2

Frequency of use, and respondents' agreement for different components of the bedside swallow evaluation (BSE).

Component of the BSE	Mean Frequency ^a	Agreement ^b
Background Information		
Review patient history	5.0 ± 0.1	98
Patient interview	4.8 ± 0.5	77
Assessment of mental abilities	4.3 ± 1.2	54
Assessment of speech function	4.2 ± 1.0	52
Assessment of language abilities	4.1 ± 1.0	46
Structural and functional oral examination		
Adequacy of dentition for chewing	4.9 ± 0.4	90
Assessment of secretion management	4.9 ± 0.4	90
Oral motor examination	4.9 ± 0.4	88
Presence/strength of volitional cough	4.5 ± 0.8	67
Assessment of oral sensory function	3.9 ± 1.1	40
Presence/strength of gag reflex	2.8 ± 1.4	31
Swallowing function		
Judgement of efficiency of oral movements	4.9 ± 0.2	94
Judgement of pharyngeal delay	4.9 ± 0.3	94
Adequacy of lip seal	4.9 ± 0.3	91
Vocal quality before and after swallowing	4.9 ± 0.5	89
Using different food texture types	4.8 ± 0.5	78
Pulse oximetry while swallowing	2.7 ± 1.1	34
Cervical auscultation	2.1 ± 1.4	50

^a Mean ± SD frequency of use on a Likert scale from 1 (never) to 5 (always);

^b percentage of responses in the most common category, ranging from 20% (responses equally split between the five categories) to 100% (complete agreement on one category)

Table 3

Availability of Use of Instrumental Diagnostic Tests by University Affiliation

	University-Affiliated Hospital (n=199)	Community Hospital (n=600)	P-value
Availability			
VFSS	100%	97%	<0.01
FEES	69%	32%	<0.01
Used when Available^a			
VFSS	31%	34%	0.49
FEES	15%	8%	0.06

^a percentage of respondents reporting using test “usually” or “always”

Table 4

Frequency of use and respondents' opinion about effectiveness for different treatments of post-extubation dysphagia.

Treatment	Frequency of Use		Effectiveness	
	"Usually/Always" (%)^a	Agreement ^b	Mean^c	Agreement ^b
Dietary adjustment				
Solid food texture modifications	73	64	4.4 ± 0.6	51
Liquid thickness modifications	50	43	4.2 ± 0.8	49
Postural changes/Compensatory maneuvers				
Chin down posture	84	52	3.5 ± 1.0	38
Small sips/small amounts	82	54	4.2 ± 0.7	50
Multiple swallows	48	43	3.9 ± 0.8	54
Clearing cough	33	40	3.7 ± 0.9	44
Effortful swallow	33	45	3.6 ± 0.9	42
Mendhelson maneuver	10	58	2.9 ± 1.0	38
Head turn to one side	8	61	3.2 ± 1.0	38
Supraglottic swallow	8	63	3.0 ± 1.0	40
Interventions to improve swallow function				
Masako maneuver (tongue hold swallow)	20	36	3.1 ± 1.0	33
Neuromuscular electrical stimulation	6	47	2.6 ± 1.3	27
Deep nerve stimulation	2	70	1.9 ± 1.1	49

^aPercentage of respondents reporting "usually" or "always" using each treatment, based on a Likert scale from 1 (never) to 5 (always);

^bpercentage of responses in the most common category, ranging from 20% (responses equally split between the five categories) to 100% (complete agreement on one category);

^cMean ± SD of the perceived effectiveness of each treatment based on a Likert scale from 1 (not effective) to 5 (very effective).