Tough Pill to Swallow: Postextubation Dysphagia and Nutrition Impact in the Intensive Care Unit

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Abstract
More than 5 million patients are admitted to US intensive care units (ICUs) each year. Many of these patients have risk factors for dysphagia. Dysphagia must be promptly addressed and appropriately treated to avoid the deleterious impact of aspiration and malnutrition. Therefore, clinicians must be aware of ways to identify and treat dysphagia. This review will highlight the risk factors, mechanisms, and impact of dysphagia in the ICU as well as provide screening, diagnostic, and management options. (Nutr Clin Pract. 2021;36:80–87)

Keywords
aspiration; dysphagia; intensive care unit; malnutrition; mechanical ventilation

Introduction
More than 5 million patients are admitted to US intensive care units (ICUs) each year.¹ Mechanical ventilation is the most common technological support, being required by 20%–40% of adult ICU admissions.¹ Patients liberated from mechanical ventilation are at increased risk for swallowing dysfunction.² The reported incidence of postextubation dysphagia (PED) varies significantly.² One study found that PED was present in 84% of patients, and this was even after the exclusion of patients with stroke and/or neuromuscular disease.³ PED has been associated with poor patient outcomes, including increased risk of reintubation, development of pneumonia, prolonged hospital admissions, discharge to a nursing home, increased risk of death, and need for surgically placed feeding tubes.³ Dysphagia is also associated with malnutrition and dehydration.⁴,⁵ Therefore, it is of utmost importance that clinicians be aware of ways to identify and manage dysphagia. The goal of this review is to highlight the risk factors, mechanisms, and impact of dysphagia in the ICU as well as to provide screening, diagnostic, and management options.

Dysphagia in the ICU
Dysphagia is the difficulty or inability to effectively and safely transfer food and liquid from the mouth to the stomach. If not recognized and addressed early, dysphagia may result in aspiration of solids or liquids. Aspiration does not need to be confined to prandial materials. Aspiration of oropharyngeal, pulmonary, or gastric secretions contributes to the incidence of aspiration complications.⁶ For reference, a healthy adult produces an average of 0.5—1.5 L of saliva and swallows >500 times daily.⁷

Aspiration is not always identified by typical signs or symptoms such as coughing or choking. Silent aspiration is a covert form of aspiration that occurs without overt clinical signs or symptoms. Silent aspiration is caused by desensitization of the pharynx and upper airways⁸ and is diagnosed through instrumental swallow evaluations. One meta-analysis and systematic review including 38 studies, 5798 patients, and 1957 dysphagic events noted a high incidence of postextubation silent aspiration.² The authors calculated the combined weighted incidence of PED to be

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41% (95% confidence interval, 0.33–0.50), with 36% of the patients with PED having silent aspiration (95% confidence interval, 0.22–0.50). Without instrumental swallow evaluations, silent aspiration may go unidentified and result in pulmonary sequelae, including airway obstruction, chemical pneumonitis, and pneumonia. Therefore, utilization of swallow evaluations cannot be undermined.

Omitting or delaying a swallow evaluation may also result in malnutrition, unwarranted feeding tube placement, or incorrect diet texture prescription. Even when addressed early and appropriately, dysphagia can negatively impact dietary intake. Dysphagia is associated with malnutrition. Like PED, malnutrition is associated with prolonged hospital stay, financial burden, and mortality. To avoid the deleterious effects of aspiration and malnutrition, swallowing capacity should be assessed postextubation and in patients with a high risk for dysphagia.

**Risk Factors**

A review of the literature on PED provides a variety of causes without a consensus. Comorbidities, intubation trauma, effects of prolonged intubation, laryngeal pathologies, and reduction of sensation/sensorium following endotracheal extubation impact swallow function. One retrospective, observational cohort study including 446 patients noted that mechanical ventilation for >7 days was independently associated with moderate or severe dysphagia (adjusted odds ratio, 2.84; interquartile range, 1.78–4.56; \( P < 0.01 \)).

Table 1 lists risk factors for dysphagia.

| Category       | Examples                                                                 |
|----------------|---------------------------------------------------------------------------|
| Neurological   | Stroke, Head injury, Multiple sclerosis, Parkinson disease, Amyotrophic lateral sclerosis, Cerebral palsy, Myasthenia gravis, Huntington disease, Spinal cord injury, Dementia |
| Obstructive    | Head and neck cancer and treatment (surgery, chemoradiation), Gastroesophageal reflux disease |
| Muscular       | Scleroderma, Achalasia, Muscular dystrophy                                |
| Other          | Trauma or surgery involving the head and neck, Oral intubation or tracheostomy, Dyspnea or tachypnea, Desensitization of oropharynx, larynx, and upper airways, Decreased mental status, Laryngeal pathologies following intubation, Decompensated elderly patients |

**Screening**

There is a lack of consensus on when to conduct a swallow evaluation. Some studies suggest testing immediately postextubation, whereas others recommend waiting between 1 and 5 days. Leder et al studied the swallowing function of 202 adult patients from 5 different ICUs. Swallow evaluations were conducted at 1, 4, and 24 hours postextubation to determine the necessity of delaying swallowing assessments. Of the 202 patients studied, 166 patients (82.2%) passed the Yale Swallow Protocol at 1 hour postextubation, with an additional 11 patients (87.6%) at 4 hours, and 8 more patients (91.6%) at 24 hours. Only an intubation duration of ≥4 days was significantly associated with nonfunctional swallowing. Although the authors note that these results suggest not delaying swallow evaluations postextubation, the individual patient must be assessed for appropriateness. If mental status or respiratory function is tenuous, delaying the evaluation may be prudent.

Many studies have evaluated the impact of the presence of oral or nasal feeding tubes on aspiration. Studies have evaluated different tube sizes and different populations. Findings have been equivocal. Most studies note increased oral and pharyngeal transit times with the presence of a nasal or oral tube, though this may or may not impact aspiration risk. Based on these conflicting data, there are no recommendations regarding removing or maintaining feeding tubes during a swallow evaluation.

A swallow screen is a nursing-administered tool to identify PED. One national survey of inpatient speech pathologists indicated that only 41% of hospitals use a bedside PED-screening protocol before initiating oral intake. Multiple validated swallow screens exist, including those specific to the stroke population: the Toronto Bedside Swallowing Screening Test and the Barnes Jewish Hospital Stroke Dysphagia Screen.

The Yale Swallow Protocol (formally known as the 3-oz Water Swallow Test) is another validated swallow screen implemented by nursing to determine a patient’s ability to swallow. The screening is judged on a pass/fail basis. Patients who fail the screen must undergo formal evaluation by a speech pathologist.

The Yale Swallow Protocol is composed of 3 parts (Figure 1).

First, a questionnaire about the patient’s alertness and medical history is completed. If there is an answer of “yes” to any of the questions in the questionnaire, then the screen is deferred to a formal swallow evaluation by a speech pathologist. If the questionnaire is completed with “no”
Step 1a. Yes/no questionnaire
Patient unable to remain alert during testing?
No thin liquids due to preexisting dysphagia?
Head of bed restriction < 30°
Tracheostomy tube present
NPO for medical/surgical reason

Step 1b. Perform Brief Cognitive Screen
- What is your name?
- Where are you right now?
- What year is it?
- Open your mouth.
- Stick out your tongue.
- Smile.

Step 1c. Perform Oral Mechanism Evaluation
Labial Closure
Lingual range of motion
Facial symmetry (smile/pucker)

Step 2. 3-oz Water Swallow Challenge
Sit patient upright at 80°–90° (or as high as tolerated); >30°
Ask patient to drink entire 3 oz water slowly and steadily without stopping

Step 3. Pass Criteria
Complete and uninterrupted drinking of 3 oz water
No overt signs of aspiration (cough, choking) during/after drinking
Initiate oral diet

Step 3. Fail Criteria
Interrupted drinking or coughing or choking during or immediately after drinking
Keep NPO
Rescreen in 24 hours or SLP evaluation

Figure 1. Yale Swallow Protocol. FEES, Fiberoptic Endoscopic Evaluation of Swallow; SLP, Speech-Language Pathologist; VFSS, Videofluoroscopic Swallow Study.

The Yale Swallow Protocol, developed by the Department of Otolaryngology at Yale University, offers a structured approach to swallowing assessment. The protocol includes a yes/no questionnaire, a brief cognitive screen, and an oral mechanism evaluation before proceeding to a 3-ounce water challenge. Patients who successfully complete the challenge are cleared for an oral diet. Those who fail move on to further evaluation, either through retesting within 24 hours or referral to a speech pathologist.

Second, qualifying patients are given a 3-ounce water challenge in which patients are instructed to consume 3 ounces of water via uninterrupted drinking.

The final step is interpreting pass/fail results. If the patient passes the screen, an oral diet is started. If the patient fails the screen, next steps are based on the screener’s discretion. Either the screen can be repeated within 24 hours (if the patient is expected to improve) or further evaluation is deferred to a speech pathologist.

A double-blinded, multirater, systematic replication study investigated the agreement for aspiration risk in the same individual between videofluoroscopic swallow studies (VFSSs) and the Yale Swallow Protocol. Twenty-five adults referred for dysphagia screening participated in the study. The Yale Swallow Protocol showed 100% sensitivity for detecting aspiration, 64% specificity, 78% positive predictive value, and 100% negative predictive value. Currently, there is a trial underway to determine the sensitivity and specificity of the Yale Swallow Protocol in identifying
Diagnostic Process

A patient’s swallowing ability is evaluated through 3 different modalities.

Clinical Swallowing Evaluation (CSE) is a bedside, observational evaluation of swallowing to identify overt signs and symptoms of aspiration and/or dysphagia. CSEs are performed as a first step in the evaluation of swallowing. When patients demonstrate signs or symptoms of aspiration and/or further objective information is needed prior to starting an oral diet, an instrumental evaluation is pursued.

VFSS (also known as a Modified Barium Swallow [MBS]) is an instrumental evaluation performed by a speech pathologist and radiologist (and/or radiologist technician) in a fluoroscopy suite. VFSS/MBS involves the administration of various consistencies of foods and liquids mixed with barium under fluoroscopic guidance to objectively identify the pathophysiology of the swallow and to rule out aspiration. Compensatory strategies and trial therapy are attempted during VFSS/MBS to facilitate a patient’s return to an oral diet. The radiologist diagnoses any musculoskeletal irregularities and aspiration. The speech pathologist also interprets the study to identify aspiration and pathophysiological dysfunction as well as provides clinical recommendations. Figures 2A and 2Bb are images from VFSS. A shows deep supraglottic penetration of mildly thick liquids on lateral view of the cervical osteophytes C3–C6. B suggests mild supraglottic penetration without aspiration on anteroposterior view.

Fiberoptic endoscopic evaluation of swallow (FEES) is another instrumental modality of swallowing evaluation. It involves use of a nasopharyngeal endoscope that is inserted transnasally to visualize the pharyngeal and laryngeal structures during the act of swallowing. Food and liquids of varying consistencies are mixed with food dye to provide contrast for the identification of aspiration, penetration, and pharyngeal stasis to determine the appropriate diet level. Figure 3 shows a transverse view of the oropharynx, pharynx, hypopharynx, and larynx during FEES.

In facilities or programs equipped with the ability to perform both VFSS/MBS and FEES, determining the best
modality for a given patient involves several clinical and logistical factors. Figure 4 is an algorithm to guide decision-making in which tool to use.

Use of systematic screening processes following extubation is helpful in the identification of PED. Ideally, positive screening results are complemented by formal bedside and/or instrumental evaluation by a speech pathologist. Miles et al suggest that early endoscopic swallowing evaluations following cardiothoracic surgery were helpful in identifying aspiration and laryngeal pathologies leading to earlier management and lower complications associated with aspiration.

Adequacy of Oral Intake

As mentioned previously, dysphagia increases the risk for inadequate oral intake. Modified diet and liquid textures have low acceptability, which can result in decreased intake. They are also associated with significantly worsened quality of life. Up to half of patients have been reported as being noncompliant with modified diet recommendations. Swallowing difficulty often requires more time and effort to consume meals. Fatigue and improper food temperatures may deter patients from completing meals. Extra calories are expended with prolonged chewing and additional swallows. Food aversions associated with coughing or choking may also develop. A double-edge sword exists between dysphagia and nutrition: poor nutrition status further impairs dysphagia. Malnutrition and corresponding loss of muscle mass in the mouth and pharynx can compound existing dysphagia. Neurological or cognitive impairment causing dysphagia may also negatively impact other aspects of nutrition (eg, self-feeding ability, food pocketing, etc).

Registered dietitians (RDs) can compare caloric intake to calculated or measured energy needs. However, oral intake may be difficult to quantify. Calorie counts have often been utilized but are typically inaccurate. Calorie counts may not include all foods consumed throughout the day, particularly snacks or foods used with medications (eg, pudding, applesauce). The nutrient composition of food brought in by family may be difficult to determine. Approximation of serving sizes and percentage intakes can vary between those recording the intake. Often, nurses and nursing assistants have the best indication of a patient’s oral intake given their position at the bedside. Non-fluid-related weight loss, muscle loss, and subcutaneous-fat loss also indicate suboptimal intake. These losses take time to manifest; it is prudent to closely

| Clinical | Logistical |
|----------|------------|
| FEES     | VFSS       |
| FEES     | VFSS       |

**Figure 4.** Decision-making algorithm for determination of instrumental tool to use. FEES, fiberoptic endoscopic evaluation of swallow; VFSS, videofluoroscopic swallow study.
monitor and address inadequate intake before it manifests in physical losses.

**Dysphagia Management**

In the ICU setting, dysphagia is generally managed through modification and/or compensation. Modification refers to the altering of the consistency of food and liquids. Compensation involves training strategies to mitigate or eliminate aspiration through postural changes or sequenced swallow strategies. Modification and compensation methods are described in more detail below. Because of the critical nature of patients and the time constraints to affect significant restoration of acquired or chronic swallowing dysfunction, extensive rehabilitative swallowing therapy is not usually feasible within the ICU. Thus, it is important to pair a patient’s functional ability with the appropriate interventions to realize an achievable outcome.

**Modification**

Modified diets alter the transport or flow of foods and liquids to facilitate safer swallowing in dysphagic patients. Based on a patient’s clinical or instrumental evaluation, a modified diet may be recommended. Modified diets include semisolid, soft solid foods, and thickened liquids. Semisolid or soft solid diets can be utilized for oral weakness or edentulism. Thickening liquids increases their viscosity, thus reducing flow velocity and potentially decreasing penetration-aspiration risk. The International Dysphagia Diet Standardisation Initiative (IDDSI) has standardized the consistency of modified diets. As part of this initiative, a framework of modified diets and thickened liquids was developed (Figure 5). The continuum is characterized by numbers, text labels, and color codes. Each level is accompanied by a description, physiological rationale, and flow test. There are 8 levels of differing textures/viscosities: levels 0–4 are composed of liquids and levels 3–7 are composed of foods. The
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There are multiple ONS or consistently inadequate oral intake. It may be appropriate for patients with significant dysphagia and inadequate oral intake after endotracheal extubation (eg, current/past neurological injury or malnutrition), it may be prudent to maintain nasogastric tube placement for a period of time. Bedside assistance with encouragement of meals and ONSs may be helpful in increasing intake. Family member involvement in mealtimes can also be supportive.

Enteral nutrition (EN) is an option to supplement oral intake. In cases when the patient may be at high risk for dysphagia or inadequate oral intake after endotracheal extubation (eg, current/past neurological injury or malnutrition), it may be prudent to maintain nasogastric tube placement after extubation. Often, speech pathologists can gauge the likelihood of dietary adequacy given the degree of dysphagia and time required to complete the swallow evaluation. RDs can determine the presence of malnutrition, adequacy of intake, and the need for and timing of EN. There should be a lower threshold for EN initiation for patients with malnutrition. EN can be provided continuously (typically if oral intake is poor, <25% of meals) or cyclically/nocturnally (if oral intake is improving but still inadequate). Long-term enteral access in the form of a surgically placed feeding tube may be appropriate for patients with significant dysphagia or consistently inadequate oral intake.

Case Study

A 45-year-old, well-nourished male with no previous medical history was admitted to the ICU with pneumonia secondary to coronavirus disease 2019 (COVID-19) infection. He was intubated, sedated, and started on veno-venous extracorporeal member oxygenation (ECMO) on admission. The patient was placed in prone position for 16 hours daily and received postpyloric EN. On hospital day 8, ECMO was discontinued, and on hospital day 13, he was extubated. After extubation, the patient was oriented to all 4 spheres and confirmed to have no previous dysphagia history or weight loss. Nursing administered the full Yale Swallow Protocol without positive signs of aspiration; however, nursing concern remained for dysphagia because of voice impairment. Speech pathology was consulted to perform a CSE. The CSE noted dysphonia with concerns for silent aspiration. The patient was trained in basic phonation exercises and trialed with a super-supraglottic swallow maneuver. The Ear, Nose, Throat service (ENT) was consulted to evaluate the patient’s larynx. Endoscopy noted bilateral posterior granulomae and a large glottic gap likely attributed to weakness. A nasogastric tube was placed for EN. Phonation, secretion management, and clinical tolerance of bedside swallow trials continued to improve, and on day 20, the patient was sent for VFSS (after 2 negative COVID-19 swabs). VFSS revealed deep, supraglottic penetration with subsequent microaspiration of mildly and moderately thick liquids despite use of compensatory strategies. Frank, silent aspiration of thin liquids was also noted. ENT followed up to reevaluate laryngeal pathologies and found improved right true vocal fold (TVF) mobility with paralyzed left TVF in the paramedian position and continued glottic gap. Vocal injection was performed for improved adduction and airway protection. The patient underwent TVF medialization with follow-up VFSS, demonstrating supraglottic penetration of thin liquids using a modified super-supraglottic swallow maneuver. He was started on a dysphagia soft diet with mildly thick liquids. Given the patient’s increased motivation to eat, nasogastric tube was removed. Intake and swallowing proved adequate, and the patient was discharged to an acute rehab unit.

Conclusion

Dysphagia is common in the ICU and is associated with poor clinical outcomes. Efforts to identify swallowing difficulties must be implemented early in patients’ care. Various screening tools and instrumental techniques are available to identify dysphagia. Modified dietary textures and other compensatory techniques can increase swallowing safety in the ICU. A multidisciplinary approach is helpful in screening, diagnosing and treating dysphagia to ensure safe and adequate intake.
Statement of Authorship

S. Dobak and D. Kelly contributed to conception/design of the research; acquisition, analysis, and interpretation of the data; drafted the manuscript; critically revised the manuscript; and agree to be fully accountable for ensuring the integrity and accuracy of the work. All authors read and approved the final manuscript.

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