REVIEW OPEN ACCESS

Dysphagia in Epilepsy Patients

The Silent Enemy

James W. Wheless, BScPharm, MD, Brooke Richardson, MS, CCC-SLP, Clio Rubinos, MD, MS, Raymond Faught, MD, and Marry Vuong, PharmD, BCPPS

Correspondence
Dr. Wheless
jwheless@uthsc.edu

Neurology: Clinical Practice 2025;15:e200362. doi:10.1212/CPJ.0000000000200362

Abstract

Purpose of Review

Dysphagia, or difficulty swallowing, affects several individuals globally and can contribute to a reduced quality of life and partial medication adherence, especially in patients with epilepsy. There is also a lack of awareness and understanding of dysphagia among both health care providers and patients. This review examines the interplay between dysphagia and epilepsy treatment and the potential for optimizing diagnosis and intervention.

Recent Findings

Dysphagia, although a prevalent condition, is often underdiagnosed or misdiagnosed. Managing dysphagia involves patient and caregiver education on medication management techniques, lifestyle changes, and collaboration with a multidisciplinary health care team. There are also several modalities to screen and evaluate for dysphagia by using technology, using questionnaires, and asking probing questions. In patients with epilepsy, dysphagia can make swallowing certain formulations of antiseizure medications (ASMs) difficult or impossible—so, there is a need for tailored management strategies if discontinuing the medication is not feasible. Alternative formulations such as soluble, liquid, granular, or powder alternatives have been recognized as valuable options in addressing partial adherence due to dysphagia.

Summary

Patients with dysphagia may have varying symptoms, making it challenging for clinicians to accurately identify the condition. To address this issue, various questionnaires and assessments have been developed to uncover swallowing difficulties. Administration of alternate ASM formulations must consider options available for each individual.

Introduction

Swallowing difficulty, or dysphagia, is a prevalent condition in various age groups and conditions. Dysphagia is typically categorized by clinicians as oropharyngeal dysphagia (OPD) or esophageal dysphagia.[1,2] The global prevalence of OPD is estimated to be 43.8% and is often attributable to other comorbid conditions. Despite a high global prevalence, several patients do not seek care for their swallowing difficulties and are underdiagnosed or misdiagnosed.

Health care providers may have a limited understanding of dysphagia. A 2021 survey of 396 health care providers (nurses, physicians, auxiliary nursing care technicians) in Spain revealed that only 63.2% of respondents reported that they knew the definition of dysphagia.[3] The Eating Assessment Tool-10 (EAT-10) score is commonly used as a self-screening tool for

Pediatric Neurology (JWW), University of Tennessee Health Science Center; Neuroscience Institute & Le Bonheur Comprehensive Epilepsy Program (JWW), Le Bonheur Children's Hospital, Memphis, TN; The Modern MedSLP (BR), Raleigh, NC; Neurocritical Care and Epilepsy (CR), UNC School of Medicine, Chapel Hill, NC; Epilepsy Center (REF), Emory Healthcare, Atlanta, GA; and Department of Neurology and Neurosurgery (MV), Nicklaus Children's Hospital, Miami, FL.

Funding information and disclosures are provided at the end of the article. Full disclosure form information provided by the authors is available with the full text of this article at Neurology.org/cp.

The Article Processing Charge was funded by the authors.

OPD (eAppendix 1). Up to 20.8% of respondents have conducted the EAT-10 screening test, with 39.2% of respondents expressing that they do not know what the EAT-10 screening test is. A lack of understanding of the diagnosis, assessment, and clinical management techniques for dysphagia can lead to delayed care, complications, and emergency department visits. There is a lack of data in the literature suggesting whether the understanding or definition of dysphagia is consistent for providers in the United States.

Geriatric patients diagnosed with nonaspiration pneumonia have been observed to receive fewer consults for dysphagia than geriatric patients with aspiration pneumonia.[4] Although aspiration pneumonia is a possible complication of dysphagia, the absence of aspiration pneumonia in a patient with dysphagia should not preclude referrals to dysphagia specialists, especially considering the effects of dysphagia on quality of life (QoL). Gender disparities were also found to be a factor for a patient receiving a dysphagia consult. Male patients with aspiration pneumonia were significantly more likely to receive a speech-language pathologist (SLP) dysphagia consult ($p = 0.022$).[4]

Dysphagia poses a significant health concern because it may lead to complications such as partial medication adherence, dehydration, malnutrition, and aspiration pneumonia.[5] Medication adherence is especially critical in patients with epilepsy because partial adherence can result in lower plasma levels resulting in seizures, accidents, and seizure-related hospitalizations.[6] It can be difficult to achieve the therapeutic levels for an antiseizure medication (ASM) to be efficacious if patients are not properly taking their medication.

Difficulty swallowing negatively affects several aspects of life. Patients report multiple psychological and social limitations: embarrassment when eating with others, reduced ability to eat, food avoidance, and feeling handicapped or limited.[7] A large survey conducted from 2014 to 2017 assessed the self-reported EAT-10 scores of 2,054 persons aged 18–65 years. In societies with easier access to health care, participants were found more likely to seek help earlier for swallowing difficulties. Despite modifying their lifestyle and having EAT-10 scores consistent with low QoL, participants repeatedly expressed that they did not have swallowing problems. These results suggest that the definition of dysphagia may not be clear for patients and that they do not report difficulties because they were not aware of this medical condition. Several older patients believe dysphagia to be a normal part of aging or adapt their lifestyle habits to accommodate any swallowing difficulties and do not seek care.[8]

Despite the many comorbid diseases and factors that contribute to dysphagia, it is a common and limiting problem that is often underdiagnosed. In this review article, we examine the existing research on dysphagia, assessment methods, and management strategies, with a focus on understanding the complex interplay between the treatment of epilepsy in patients with dysphagia and identifying potential avenues to optimize diagnosis of dysphagia and clinical intervention.

Dysphagia: An Overview

Dysphagia may occur across all age groups, from neonates to older adults. The prevalence of pediatric dysphagia is reported up to 94%, depending on how dysphagia is defined and which subgroup is studied.[9] Most children with dysphagia present with other disorders, but up to 25% of children with normal development can experience dysphagia.[9] Patients may present with swallowing complications due to physical/structural abnormalities, abnormalities of the gastrointestinal (GI) tract that may require enteral feeding tubes, or congenital/genetic malformations.[1,2,10,11] Lennox-Gastaut syndrome is one of the childhood epilepsy syndromes in which patients may develop rapid onset of swallowing difficulties.[12]

In older individuals, OPD often results from comorbidities such as dementia, neurologic and respiratory conditions, brain injuries, surgeries, or cancer.[10,13] Some of these conditions are also linked to late-onset epilepsy (LOE), which manifests after the age of 60, peaking in incidence beyond 75 years, with structural changes to the brain being the most common causes.[14] For instance, LOE is found in approximately 30%–50% of patients with cerebrovascular disease, around 25% of those with traumatic brain injuries, 10%–20% of patients with neurodegenerative diseases, and 10%–30% of those with brain tumors.[15-17] Although the relationship between dysphagia and LOE has not been extensively explored, it would not be surprising to observe both conditions in the same patient. Indeed, neurogenic dysphagia is a common and prominent issue in patients with central/peripheral nervous system, neuromuscular, or muscular diseases.[18] Dysphagia may be present in at least 50% of patients with ischemic or hemorrhagic stroke and approximately 60% of patients with traumatic brain injury. OPD may also be the result of acute conditions including dehydration, urinary tract infections, congestive heart failure, and pneumonia.[4] Pneumonia is a leading cause of death in the older population, and dysphagia is frequently associated with pneumonia.

Esophageal dysphagia can be caused by motility disorders, structural abnormalities, or infiltrative and systemic causes.[11] Examples of esophageal dysphagia include achalasia, diffuse esophageal spasm, and hypercontractile esophagus. Esophageal and gastric cancers may also lead to esophageal dysphagia because tumors can cause mechanical obstructions. Lastly, infiltrative and systemic diseases, such as scleroderma and eosinophilic esophagitis, can cause indirect esophagitis tissue atrophy and fibrosis.

Dysphagia can also stem from nonorganic causes and affect patients of all ages. Phagophobia is a form of psychogenic

dysphagia and is characterized by fear/avoidance or perceived difficulty of swallowing food, fluids, or solid medications, despite normal physical and laboratory findings.[19] Dysphagia in these patients can also be attributed to anxieties surrounding choking or dying from improperly swallowing.[20] Patients can also have partial medication adherence due to anxiety around pill intake.

Functional dysphagia is a swallowing disorder not caused by anatomical obstructions or lesions, rather due to issues with the functional aspects of swallowing.[21,22] This type of dysphagia may be more difficult to differentiate and diagnose from other dysphagia types, so patients should be referred to a functional neurology specialist. Functional dysphagia can be caused by neurologic conditions, muscular disorders, psychological disorders, or coordination/lack of muscle strength that facilitates swallowing.

An overview of dysphagia types and examples of commonly associated conditions is presented in Table 1.[2,10,11,21,23]

Impact of Dysphagia on Medication Adherence

In addition to dietary restrictions and potential effects on nutrition, several patients can choke on pills, leading to partial adherence and the potential to suffer the consequences of their undertreated disease. An observational study of 118 pediatric patients with epilepsy was conducted to determine adherence barriers on ASM adherence and seizure control.[24] Results demonstrated that lower adherence was significantly linked to difficulty swallowing ASMs at 25 months after epilepsy diagnosis. At 25 months after epilepsy diagnosis, children with difficulty swallowing reported a 38.8% rate of adherence, whereas children with no difficulty swallowing had a 60.4% adherence rate. Decreased adherence, especially in patients with epilepsy, contributes to uninformed clinical interventions, increased health care costs, and higher incidence of hospitalizations.[25] Children with lower adherence in the first 6 months of therapy are 3.2 times more likely to have continued seizures for a longer period.[26]

Screening for Dysphagia

Early identification and intervention for dysphagia can improve QoL and reduce further medical complications and hospital readmission.[27] Clinicians should carefully evaluate and assess both the patient's presentation and history, in addition to conducting dysphagia-related questionnaires and physical examinations, as part of the process in identifying the need for referrals to dysphagia experts.[23]

Each patient's perception of their symptoms can vary widely.[28] As a result, patients' self-reporting of their swallowing abilities can sometimes be inconsistent with the results of their clinical evaluations, making it challenging for clinicians to accurately assess swallowing function in a

Table 1 Dysphagia Types and Commonly Associated Clinical Conditions[2,10,11,21,23]

Dysphagia type	Definition	Associated clinical conditions
Oropharyngeal	Impairment of mastication, bolus control, and/or transit of the bolus from the oral cavity to the cervical esophagus	• Cognitive impairment • Developmental delay • Medications • Myopathy disease (myositis, muscular dystrophies) • Neurologic disorders (neurodegenerative, neuromuscular, multiple sclerosis, traumatic brain injury, peripheral/CNS disorders) • Respiratory conditions • Structural abnormalities (tumors, infections, radiation injuries, surgical resection, lymphadenopathy, poor dentition) • Xerostomia
Esophageal	Difficulty clearing the bolus from the esophagus into the stomach	• Functional esophageal or motility disorders (achalasia, heartburn, gastroesophageal reflux disease, reflux hypersensitivity, esophageal spasm, hypercontractile esophagus) • Hypertension of the lower esophageal sphincter • Infections (infectious esophagitis, herpes simplex virus, cytomegalovirus, *Candida*) • Medications • Obstruction (thyromegaly, tumors, cardiac enlargements or abnormalities, previous surgery, or radiation) • Rheumatologic conditions (scleroderma, Sjögren syndrome, sarcoidosis) • Structural or mechanical conditions (food impaction, malignancy, esophageal stricture)

holistic fashion. The potential for limited reliability of reported history and subjective symptoms requires clinicians to use a variety of clinical tests to further assess dysphagia, rule out alternative diagnoses, and definitively diagnose dysphagia.[29] When possible, it is also recommended for providers to interview family members and caregivers to help uncover any additional information the patient may be too embarrassed to express or is subconsciously adapted not to notice themselves.[29]

Initial screenings are easy to perform and often play an important role in determining the presence, and sometimes etiology, of dysphagia.[29,30] Observing a patient drinking water or eating solid food may provide the neurologist some information regarding the patient's swallowing function and can be quickly conducted if there are signs pointing to diminished swallowing function. Recognizing limited mental status, dry mouth (xerostomia), coughing, choking, drooling, or goiters can point to potential dysphagia. OPD is commonly caused by chronic neurologic conditions and usually manifests as coughing, choking, or difficulty initiating swallowing.[2,8] These characteristics can also be secondary to conditions that cause weakening muscles, such as amyotrophic lateral sclerosis, thyroid problems, or oropharyngeal/esophageal dysfunction.[23] However, there are several more advanced and specialized assessment tools that dysphagia specialists can use to formulate a diagnosis. Referrals to clinicians with dysphagia expertise (such as a SLP and gastroenterologist) for assistance in distinguishing and categorizing each case of dysphagia are essential for providers because each distinct type of dysphagia has a unique etiology, set of symptoms, and management considerations.[23,30,31]

Table 2 presents a list of questions that health care providers may use in dysphagia screening during practice. This screening may also help identify patients who may not have swallowing difficulties but may prefer an alternative ASM formulation because of preference and those who are too young, nonverbal, or unable to provide a primary history.

Evaluation of Dysphagia: The Role of the SLP

SLPs are widely considered the preferred professionals for evaluating and managing speech, language, communication, and swallowing disorders for individuals throughout their lifespan. They practice in a variety of health care environments, including acute care facilities, outpatient clinics, inpatient rehabilitation centers, and home health care settings. The fundamental responsibility of an SLP is to align dysphagia assessment and management with the values and needs of each patient, primarily focusing on enhancing the QoL and promoting patient health through appropriate evaluations, individualized treatment, and referrals to other specialists.

SLPs use the clinical swallow evaluation and several questionnaires to better quantify and interpret the common subjective symptoms of dysphagia.[29,32,33] Because most of the questionnaires aim to gather detailed and relevant disease information, such as chronicity, frequency, and severity of symptoms, health care providers commonly use questionnaires to ensure a thorough dysphagia assessment. The Sydney Swallow Questionnaire and the Mayo Dysphagia Questionnaire are 2 common tools designed for use in the general population.[32,33] Beyond standardizing and customizing dysphagia assessment, questionnaires have played a crucial role in generating quantitative data related to dysphagia. This has facilitated a more efficient integration of subjective patient symptoms into objective disease studies. Table 3[7,32,33] provides a summary of questionnaires to aid in identifying dysphagia.

A clinical swallowing evaluation by an SLP is an important first step in determining indications for further evaluation of OPD through instrumental swallow assessments. When evaluating for OPD, a flexible endoscopic evaluation of swallowing (FEES) procedure allows for a superior view of the larynx and pharynx while the patient consumes various consistencies of food and liquid. The modified barium swallow (MBS) study, also known as a videofluoroscopic swallow study, is a videofluoroscopic examination providing lateral and/or anteroposterior (AP) evaluation of the oropharynx and cervical esophagus while the patient consumes various consistencies of barium or foods mixed with barium.[27,29,34,35]

In most cases, the MBS should include a complete esophageal sweep to identify the possibility of esophageal dysphagia, which could affect treatment planning and which may also result in a referral for further GI evaluation.[34] It is crucial to note that only MBS and FEES—not the clinical swallow evaluation—can identify the presence or absence of aspiration/oropharyngeal dysphagia, and that these examinations provide critical information regarding swallowing physiology that must be used for planning individualized treatment programs and additional management strategies. Clinicians reported a significant difference in the ability to directly visualize anatomical sites, with most sites being better visualized on the FEES than MBS ($p < 0.05$).[36] It is suggested that patients are first referred to speech pathology for a clinical swallow evaluation; then, the SLP can determine whether further assessment by FEES or MBS is indicated or whether the patient requires a referral to a GI specialist.[37]

For assessing dysphagia related to esophageal motility disorders, the barium swallow is commonly used, although high-resolution impedance manometry is considered best suited.[29,30] Esophagogastroduodenoscopy performed by a gastroenterologist can provide accurate information on esophageal anatomy and is commonly the first diagnostic test used in certain types of dysphagia.[35]

Table 2 Useful Questions to Screen Patients for Dysphagia in Clinic

Topic	Questions
Medication intake Goal: assess factors in medication adherence and patient preferences	• Do you have difficulty swallowing your medication?[a] • What are your thoughts on the size of your pills? Are they small enough for you to swallow?[a] • What kind of medication formulation would you prefer, a solid, liquid, or other?[a] • Do you open or crush your medication to swallow it more easily? • Have you missed any doses of your medications due to difficulty swallowing it? • How many other medications do you have to take throughout the day, including over-the-counter medications? What kind of formulations are they?
Food intake, general Goal: assess level and characteristics of dysphagia, evaluate whether referral to specialists (SLP, gastroenterologist) is indicated	• How long have you experienced difficulty with swallowing?[a] • Have you ever had your swallowing evaluated by a speech pathologist (speech therapist) or gastroenterologist using a camera, scope, or x-ray machine?[a] • Do you experience any complications with swallowing (chest pain, choking, coughing)?[a] • When you ingest food or liquid, does anything get stuck in your mouth and/or throat, making it difficult to swallow? • When you are drinking or eating, does it feel like anything goes down the wrong pipe toward your lungs? Does it make you cough or choke? • Have you changed any of your eating habits due to difficulty swallowing? • Have you lost any weight unexpectedly? • Does it take you longer to swallow food, liquid, or pills than it might have 6 months ago? A year ago?
Obtaining history from nonverbal patients Goal: probe caregivers for primary history indicating difficulty swallowing, given a patient is nonverbal or unable to communicate	• Can you describe any past medical conditions or significant illnesses the patient has experienced? • Does [patient] ever spit up or refuse to take medications? • Have you noticed any signs of difficulty swallowing, such as gagging or excessive drooling? • Do you have concerns about the patient's nutrition or hydration?

[a] Questions of interest that will potentially provide the most insight during conversations with patients to identify issues with swallowing.

Table 4[27,29,34,35] provides a summary of the diagnostic tools/assessments used to identify dysphagia. A swallowing specialist will determine the candidacy (age and physical ability to perform examinations) for these various evaluations based on the intricacies of each patient.

Treatment plans are tailored to the individual's underlying swallowing pathophysiology and typically include exercises aimed at strengthening musculature or implementing compensatory strategies, in conjunction with ongoing patient and care partner education. SLPs may also provide recommendations for feeding and eating, as well as suggestions for modification to food and liquid to promote the individual's overall health. It is also critical to engage the patient in informed decision making about recommendations for diet modifications, just as clinicians would with other aspects of their care.

Given the acute and dynamic nature of patients' medical states in acute care environments, the SLP's role primarily centers on evaluation and education, prioritizing these important elements of care over the implementation of intensive strengthening exercises. In addition, dysphagia treatment in acute care is influenced by the constraints imposed by the current health care landscape and its abbreviated hospital stays.

After an official dysphagia diagnosis, a multidisciplinary team including physicians, nurses, dietitians, SLPs, pharmacists, and case managers need to continually work as a collaborative unit to provide the best patient-centered and team-based care possible.[38] The important role of the pharmacist should also not be overlooked, especially when it comes to collaboration on medication formulation selection, administration, dosing, and manipulations (crushing, splitting, diluting) for patients with dysphagia and epilepsy.

Dysphagia Management: Pharmacologic Considerations

Management of dysphagia may include patient and family/caregiver education regarding optimal eating contexts, including positioning, alertness, and the rate of eating, drinking, and/or feeding; strengthening exercises; compensatory strategies; optimizing oral health; and providing patient and caregiver education on modified diets and liquids, along with their limitations and benefits.[39,40] Clinicians should be aware that there are multiple areas of expertise within SLP, so referrals should be directed to an SLP with expertise in dysphagia.

Some ASMs, such as clobazam, phenytoin, phenobarbital, valproic acid, lamotrigine, oxcarbazepine, and gabapentin, have been found to exacerbate dysphagia.[41] Activation of dysphagia can be due to movement disorders, myopathy, or disturbance of salivation related to these medications. Management strategies should be tailored to each patient's need, if stopping the exacerbating medication is not feasible.

Table 3 Questionnaires to Help Identify Dysphagia[7,32,33]

Screening tool	Description	Considerations
EAT-10	• Self-administered, symptom-specific outcome instrument for dysphagia	• 10-question tool: quick and easy to administer • Responses may be subjective and influenced by factors such as recall bias or patient understanding
Sydney Swallow Questionnaire	• Self-administered questionnaire measure to assess the symptomatic severity of OPD using subjective symptoms	• Comprehensive assessment covering various aspects of swallowing difficulties, including symptoms, frequency, and severity • Longer questionnaire compared with some other tools, which may increase respondent burden • Similar to EAT-10, relies on self-reported data and may be subject to biases
Mayo Dysphagia Questionnaire	• Self-administered questionnaire of a patient's symptoms of esophageal dysphagia	• Incorporates both frequency and severity of symptoms, providing a more nuanced understanding

Abbreviations: EAT-10 = Eating Assessment Tool-10; OPD = oropharyngeal dysphagia.

Patients presenting with dysphagia necessitate the consideration of suitable oral dosage forms, or adaptations thereof, to facilitate the safe administration of oral medications, thus enhancing medication adherence.[42] For example, although several SLPs are less frequently recommending thickened liquids, thickened liquids are sometimes recommended to diminish the potential for aspiration and/or to increase patient comfort.

Some patients with OPD may drink only thickened liquids. In these cases, thin liquids are thickened to the appropriate level with thickening agents made of ingredients such as starches

Table 4 Swallowing Assessments Used to Help Identify Dysphagia[27,29,34,35]

Evaluation tool	Description	Levels of participation
FEES	• Endoscope is passed through the nose into the pharynx to view swallowing of saliva, food, and liquid • Direct visualization of the pharynx, larynx, and subglottic space	• Patient needs to swallow food and/or liquid mixed with food coloring or contrast while a flexible endoscope is inserted in the nasal cavity and pharynx • May be challenging to administer in very young patients or patients who cannot tolerate the procedure (e.g., due to cognitive impairments, narrow nasal passages, and nasal fractures)
MBS	• Videofluoroscopic evaluation in lateral and/or AP views while the patient swallows barium of various consistencies • Dynamic radiographic visualization of the oral cavity, pharynx, and upper airway; allows for screening of esophageal clearance	• Patient needs to be able to sit at least partially upright in a chair (e.g., Hausted) and consume barium in liquid and/or food form • Not ideal for patients with significant upper body contractures and/or large body habitus because positioning can affect visualization of key structures and movements • Patient needs to be able to follow commands for various positioning and maneuvers, including timing and amount of liquid barium consumption (typically from a large straw)
Barium swallow	• Radiographic procedure • Evaluates for esophageal motility, strictures, reflux, hiatal hernia, etc	
Esophageal manometry	• Provides readings on peristaltic and sphincter function	• Patient needs to remain still during the procedure and may be asked to swallow saliva or water at specific time points to assess esophageal function
EGD	• A flexible endoscope through the mouth into the esophagus, stomach, and duodenum • Provides visualization of the oropharynx, esophagus, stomach, and proximal duodenum	• Patient is typically sedated to minimize discomfort and does not actively participate during the procedure

Abbreviations: AP = anteroposterior; EGD = esophagogastroduodenoscopy; FEES = fiberoptic endoscopic evaluation of swallowing; MBS = modified barium swallow.

and gums. There is limited evidence suggesting that thickening liquids can reduce dysphagia-related pulmonary sequelae.[38,43] Furthermore, it may actually lead to negative effects, including dehydration, malnutrition, decreased drug release and/or bioavailability, and urinary tract infections.[43]

For difficulties in swallowing solid pills, alternative oral formulations prove advantageous.[44,45] These include liquid solutions or suspensions, orally disintegrating tablet formulations, liquid gels, and dosage form modifications including tablet crushing or the opening/mixing capsules in food/water. Such options may make it easier to swallow for certain patients with OPD and are deemed viable oral formulation options. Additional considerations for using alternative formulations are discussed further.

Crushing oral medications for administration through a feeding tube is a common practice for patients with dysphagia requiring enteral tubes.[46] Crushing carries risks because it often involves untested vehicles that could potentially alter medication bioavailability, reducing efficacy or posing safety concerns (i.e., clogging the feeding tube). This principle also extends to dietary considerations, in which cohesive and moist foods are sometimes safer to swallow and may be effective in mitigating the risk of choking in certain patients.[40] Providers should also be aware of food and drug interactions with the material of the feeding tube because certain medications may result in reduced concentrations after delivery into the enteral tubes and either need dose adjustment or should be avoided through this route.[47] Diazepam was found to have decreased absorption in polyvinyl chloride (PVC)/polyurethane tubing. Cannabidiol should not be used in tubes made with PVC because of its potential to harden and crack the tube.

Botulinum toxin injection and oral smooth muscle relaxants are also treatment options; however, they are less effective and are generally reserved for patients considered poor candidates for dilation or surgical intervention.[21] Managing distal esophageal spasm and hypercontractile esophagus involves systemic therapy encompassing the use of oral smooth muscle relaxants and pain modulators.[21,48] For those looking for more conservative approaches before pharmaceutical or surgical approaches, alternative strategies may include behavioral and dietary modifications such as positioning during and after meals, food textures, frequency of eating, and consuming peppermint oil.

Treatment of functional dysphagia may be complex and include discontinuation of motility-altering medications, trialing high-dose acid suppression, and lifestyle modifications (eating upright, avoiding exacerbating foods, thorough mastication).[21]

Formulations of ASMs

For patients with dysphagia, the formulations of ASMs are an important aspect that can affect QoL. When considering formulations of ASMs, a clinician should consider other factors, such as the need for special formulations, adherence, feeding tubes, sites of absorption of medications, food-drug interactions, and the use of thickeners. Patients with dysphagia may encounter several barriers to oral medication intake, such as the number and size of the capsules or tablets, presence of rough surfaces, or unpleasant tastes in solid forms, and may, as a result, need special formulations.[46,49] Difficulties swallowing further exacerbate these challenges. Modified formulations, including soluble, liquid, granular, or powder alternatives, offer potential solutions in patients with dysphagia.

If a nonsolid formulation is not available as a US Food and Drug Administration (FDA)-approved product, prescribers may elect to have a solid ASM compounded into an alternative formulation. Having these specialized ASM formulations may be immensely convenient for caregivers and patients, but it is important to consider the potential limitations of compounded medications. Pharmacy compounding has significantly less regulatory oversight than FDA-approved medications, and product quality can vary interfacility and intrafacility.[50] In medications with a narrow therapeutic window, such as an ASM, variability in drug concentrations may greatly affect disease control. Compounded medications also have a shorter shelf life and stability data in comparison with manufactured products. Some patients may opt for alternative routes of administrations, such as transdermal systems; nasal sprays; and rectal, orodispersible (oral films and orally disintegrating), effervescent, or intramuscular formulation. However, not all formulation alternatives may be an option because of cost barriers and the condition being treated.

A patient's adherence to their prescribed medication is crucial for its effectiveness, regardless of the disease and its severity.[51] In addition to financial considerations and medication availability, patient preferences play a significant role in medication adherence. When adult patients were surveyed for their preference for any oral pharmaceutical forms, positive attributes of tablets included ease of handling and swallowing; for granules, attributes such as ease of public consumption and pleasant texture were preferred. On the contrary, negative attributes for tablets included the desire for fewer tablets per day while granules were criticized for requiring the consumption of a large amount of liquid. Table 5[52-59] presents the different modern-era, FDA-approved antiseizure medications and their pharmacokinetic (PK) and product characteristics.[52-56,60]

When special formulations cannot fully solve the problem of dysphagia, a clinician may introduce the idea of a feeding tube to a patient. Gastrostomy and jejunostomy tubes are a viable solution for patients who cannot meet their daily nutrition and medication needs orally. When administering medications through a feeding tube, it is important to consider the sites of absorption of medication and whether PK properties

are altered by crushing. For example, medications such as phenytoin, cannabidiol, and lacosamide should not be given using a jejunostomy tube because they are poorly absorbed in the jejunum.[61,62] Always consult a clinical pharmacist when switching between feeding tubes because the lack of absorption may lead to adverse effects such as seizures. Some medications, especially those that are extended release or enteric coated, cannot be crushed.

Diluting an ASM can help improve delivery of the medication through the feeding tube, but this can negatively affect the drug bioavailability if performed improperly. Medications should be crushed, diluted, and given immediately because stability may be compromised when these medications are manipulated. Furthermore, when medications are crushed and mixed with food, clinicians should consider food-drug interactions. For example, phenytoin binds to protein components of enteral feeding products; therefore, administration should be taken 30 minutes earlier or 4 hours after enteral feeds. Diazepam should not be mixed with grapefruit juice because grapefruit juice increases the concentrations of diazepam in the body, potentially leading to more adverse effects, such as somnolence.[63]

Clinical Pearls

Dysphagia is a common condition, especially among children and older adults and those with neurologic conditions.[23] However, it is sometimes not initially recognized. To lower the rate of serious dysphagia-related complications, such as increased rates of long-term care, mortality, malnutrition, incidence of aspiration pneumonia, and medication nonadherence, it is important for clinicians to be alert and proactive in identifying patients who may have undiagnosed dysphagia and referring to an SLP and/or a GI specialist for evaluation.[64]

Early identification of, and intervention for dysphagia can improve QoL and reduce the likelihood of further medical complications.[27] Prescribers should consider incorporating patient interviews, questionnaires to identify dysphagia, clinical assessments, and obtaining medical history related to any difficulties with swallowing into their initial evaluations. However, standard initial screenings, such as observing a patient swallow, may be limited at best, and it is recommended that nondysphagia clinicians refer patients to an SLP or gastroenterologist.

Clinicians are encouraged to be aware of symptoms that have been strongly associated with dysphagia, including choking, coughing, eating meals at a slower rate, repeated throat clearance during or after meals, feelings of food being stuck in the mid-chest or throat, weight loss, changes in preference of food consistency to liquids and semisolids, and even neurologic changes in some instances.[29,30] Additional symptoms of dysphagia include difficulty initiating swallowing, difficulty chewing, chest congestion after meals, nocturnal aspiration, and recurrent chest infections (including aspiration pneumonia) without a known cause such as exposure to infectious individuals. Home care providers are often the first health care professionals to observe signs of dysphagia and thus play a pivotal role in identifying, referring, and educating patients with dysphagia.[31]

It is also of clinical relevance to note that several patients with dysphagia have additional concerns of xerostomia, which may arise from a multitude of etiologies, including specific medications and polypharmacy.[65] By commonly causing pill dysphagia, xerostomia can further exacerbate a patient's symptoms.

In patients with epilepsy and dysphagia, medication management must involve the careful consideration of individualized patient needs and limitations. Prescribing an ASM that comes in a smaller pill size may help with swallowing difficulties, but, in turn, patients might have to inconveniently take a larger quantity to achieve an effective daily dose. The same can be true when switching a patient from a solid to liquid formulation—an increase in the liquid quantity taken may be required. Prescribers should evaluate the benefits and challenges of different formulation types and what may be best to fit a patient's lifestyle needs. In addition to education regarding benefits and possible pitfalls of formulation changes, patients should be thoroughly counseled on how to store a liquid medication at the correct temperature and how to administer and measure the medication (needing to shake a suspension vs a solution). Newer formulations such as oral films and orally disintegrating tablets may be a great solution; however, they may be costly to the patient. Insurance coverage and having nonsolid FDA-approved ASM formulations including liquid solutions or suspensions on an institution's formulary plan can also affect a prescriber's ability to select an ASM appropriate for their patient.

Conclusion

Dysphagia is not solely attributed to the normal aging process but is often linked to comorbidities and various medical conditions across the age spectrum.[1,9] The perception of dysphagia symptoms can vary significantly among patients because of differences in swallowing function, age, and health literacy level. This variability can sometimes lead to inconsistencies between a patient's self-reported symptoms and objective test results, posing challenges for clinicians in accurately identifying the presence of dysphagia by assessing and using patient-reported symptoms.[29,30] To address this issue, various questionnaires have been developed to quantify and interpret subjective dysphagia symptoms, aiding health care providers in generating appropriate referrals, conducting comprehensive assessments, and considering relevant clinical factors, including in special populations.[29,30,33]

Table 5 PK and Formulations of Second-Generation and Third-Generation ASMs[9]

Generic	Trade name	Bioavailability (F) (%)	Absorption site for enteral tubes	$T_{1/2}$	Protein binding (%)	Formulations	Administration	Ability to crush or open (Y/N)
Brivaracetam	Briviact	100	GI, SI	9 h	<20	Tablet, oral solution	PO	Y (tablets are not scored)
Cannabidiol	Epidiolex	Low	GI	17 h	>90	Oral solution	PO	N/A
Cenobamate	Xcorpi	88	GI, SI	50–60 h	60	Tablet	PO	N
Clobazam	Onfi Sympazan	100	GI, SI	36–42 h	85	Tablet, oral suspension, oral film	PO	Y
Eslicarbazepine acetate	Aptiom	90	GI, SI	13–20 h	<40	Tablet	PO	Y
Felbamate	Felbatol	90–95	GI	22–25 h	25	Tablet, suspension	PO	Y
Fenfluramine	Fintepla	70	GI	20 h	50	Oral solution	PO	N/A
Gabapentin	Neurontin Gralise	35–60	GI, SI	5–7 h	0	Capsule, oral solution, tablet	PO	Y
Lacosamide	Vimpat	100	GI	13 h	<30	Tablet, oral and IV solution	PO, IV	N
Lamotrigine	Lamictal Subvenite Lamictal XR Lamictal ODT Lamictal CD	≥95	GI, SI	15–35 h	55	Tablet (standard, ER, ODT, CD)	PO	Y
Levetiracetam	Keppra Keppra XR Roweepra	≥95	GI, SI	6–8 h	0	Oral and IV solution, IR/ER tablet	PO, IV	Y
Oxcarbazepine	Trileptal Oxtellar XR	>90	GI, SI	8–15 h	40	Oral suspension, IR/ER tablet	PO	Y
Pregabalin	Lyrica	≥90	GI, SI	5–7 h	0	Capsule, oral solution	PO	Y
Rufinamide	Banzel	≥85	GI, SI	6–10 h	35	Tablet, oral suspension	PO	Y
Stiripentol	Diacomit	≥70	GI, SI	4.5–13 h	99	Capsule, powder for oral suspension	PO	N
Tiagabine	Gabitril	≥90	GI, SI	5–9 h	96	Tablet	PO	Y
Topiramate	Eprontia Topamax Topamax Sprinkle Trokendi XR Qudexy XR	≥80	GI, SI	20–30 h	15–41	Oral solution, tablet, IR/ER sprinkle capsule	PO	Tablets: Y Capsule: do not administer contents through a feeding tube
Vigabatrin	Sabril Vigadrone	60–80	GI, SI	5–8 h	0	Tablet, powder for oral solution	PO	Y
Zonisamide	Zonegran Zonisade	≥90	GI	2.5–3 d	40	Capsule, oral suspension	PO	Y

Abbreviations: CD = chewable dispersable; ER = extended release; F = bioavailability; GI = gastrointestinal; IR = immediate release; IV = intravenous; N = no; ODT = orally dissolving tablet; PO = by mouth; SI = small intestine; $T_{1/2}$ = half-life; XR = extended release; Y = yes.

Partial adherence to medications due to dysphagia remains a prevalent and modifiable factor in managing a patient's disease and is likely to be underidentified and under-reported. Formulations such as soluble, liquid, granular, or powder alternatives have been recognized as valuable options in addressing medication aversion.[46,49,51] Administration of alternate ASM formulations must consider options available for each individual ASM, and clinicians should consider factors such as special formulations, adherence, feeding tubes, sites of absorption of medications, food-drug interactions, and use of thickeners.

Multidisciplinary care between health care providers and SLPs plays a vital role in managing swallowing and feeding difficulties, especially when optimizing oral diets or changing between oral ASM formulations, in patients with dysphagia. This interdisciplinary teamwork can have a far-reaching positive impact on nutritional goals, hospital stay duration, and patient QoL among individuals with malnutrition or with metabolic-related mentation alterations that can affect safe and adequate oral intake of nutrition and medication. In addition to providing proactive education to susceptible populations (older adults, pediatric patients, patients with relevant comorbid disorders), early referrals to dysphagia experts such as SLPs can increase clinical diagnoses, improve therapeutic strategies, and maximize patient outcomes.

Case Vignette

C.R. is a 52-year-old woman with a history of spastic quadriparetic cerebral palsy, with associated seizure disorder and intellectual disability. She was admitted to the medical intensive care unit after being found minimally responsive and with seizure activity by her sister, who is also her caregiver. On admission, C.R. was found to have aspiration pneumonia with metabolic encephalopathy and signs of chronic protein-calorie malnutrition. The sister reported several days of increasing lethargy leading up to admission, with associated difficulty administering zonisamide and levetiracetam XR. Knowing the importance of the ASMs, the sister ultimately emptied capsules and crushed the tablets and then "slurried" the medication in liquid in hopes of improving C.R.'s ease of consumption. She denied any other difficulties with feeding or medication management before this event and conveyed high levels of satisfaction with the effectiveness of C.R.'s ASM.

Given the patient's poor level of alertness and signs of chronic malnutrition, the sister agreed to placement of a short-term nasoduodenal feeding tube for nutrition during C.R.'s acute illness. Neurology was consulted and recommended initiating use of intravenous levetiracetam and liquid zonisamide.

On hospital day 3, an SLP was consulted for a clinical swallow evaluation with the goal of returning C.R. to an oral diet and her usual oral medication. At this time, and on the SLP's attempts over the next several days, C.R.'s poor alertness prohibited completion of an evaluation.

By hospital day 7, C.R.'s alertness had improved, especially when her sister was present. Thus, evaluation was deemed by the SLP to be safe and medically warranted and was timed around the presence of C.R.'s sister. While there were no endorsements of dysphagia during conversations with other members of the medical team, during this interview, C.R.'s sister described a lifelong limited diet consisting only of pureed consistencies such as apple sauce, pudding, and yogurt, citing a fear that more-solid textures would cause C.R. to "choke." She noted that C.R. coughs when drinking thin liquids about once a day but that these episodes are brief and never associated with an increase in chest congestion or a fever. The sister also shared that C.R. has been dependent for feeding and oral care for her entire life; notably, these are 2 risk factors of aspiration pneumonia.[66] C.R. had never participated in a swallowing evaluation because her family did not necessarily perceive her swallowing and eating to be problematic (because they simply adjusted her diet as they saw best) and, based on family report, outpatient providers had not expressed concerns about swallowing or recommended referrals for evaluation.

The clinical swallow evaluation revealed signs of OPD consistent with C.R.'s baseline according to her sister, namely reduced head control, anterior bolus loss, and absent rotary jaw movements. Signs of aspiration and reflux were not appreciated on the examination, although it is important to note that the lack of observable symptoms does not guarantee the absence of either of these conditions. C.R.'s sister was clear in her goals: to be able to get C.R. nutrition; to bring her home; and, most importantly, to make sure C.R. was able to swallow her ASMs and prevent further seizures.

Through collaboration with C.R.'s sister, SLP, neurology, and pharmacy, the hospitalist initiated returning C.R. to a pureed and thin liquid diet with oral immediate-release (IR) levetiracetam 500-mg tablets (2 twice daily), administered by crushing and dissolving in apple sauce, and zonisamide liquid. Over the next 3 days, C.R. was able to consume baseline levels of nutrition without increased signs of dysphagia/

TAKE-HOME POINTS

- Early identification and proactive management: Early identification and intervention for dysphagia can improve quality of life and reduce the likelihood of further medical complications, such as malnutrition, aspiration pneumonia, and medication nonadherence.
- Tailored medication management: Patients with epilepsy and dysphagia may require tailored medication management, including the careful selection of alternative formulations such as liquid, granular, or powder medications to enhance adherence. Clinicians should consider individual patient needs and limitations when prescribing antiseizure medications (ASMs), evaluating the benefits and challenges of different formulation types to match the patient's lifestyle and needs.
- Interdisciplinary collaboration: Multidisciplinary collaboration between health care providers and specialists are crucial for effectively managing dysphagia and optimizing oral diets and medication formulations for patients.

aspiration while also taking her ASMs without ill effect and no signs of seizure activity. The nasoduodenal tube was removed, and the patient was discharged home, along with a recommendation for consultation with a dietitian for her chronic dysphagia and malnutrition.

This case highlights the importance of a collaborative approach in caring for patients with seizure disorders and dysphagia—previously detected or otherwise.

Acknowledgment

Medical writing and editorial support were provided by iLuma Medical Communications (Tiffannie Nguyen, PharmD, and Ilona Kravtsova, PharmD, RPh).

Study Funding

Writing support funding from Azurity Pharmaceuticals. Authors were not compensated for development, analysis, or drafting of this manuscript.

Disclosure

J.W. Wheless - Speaker's Bureau: LivaNova, Eisai, Supernus, Jazz, UCB, Neurelis, Biomarin, SKLSI, Azurity. Consulting: Jazz, Neurelis, Marinus, Biomarin, Azurity. Grants: Shainberg Foundation, TSC Alliance, NIH, Neuro Event Labs, Envision, Stoke, Xenon, Neurelis, Marinus, Epiwatch, SKLSI, Longboard, Biohaven; B. Richardson reports no disclosures; C. Rubinos - Speaker's Bureau: Marinus; E. Faught - Grant: UCB. Consultant: Azurity, Biogen, LivaNova, Neurelis, SK Life Science; M. Vuong reports no disclosures. Full disclosure form information provided by the authors is available with the full text of this article at Neurology.org/cp.

Publication History

Received by *Neurology: Clinical Practice* February 20, 2024. Accepted in final form June 4, 2024. Submitted and externally peer-reviewed. The handling editor was Editor Luca Bartolini, MD, FAAN, FAES.

Appendix Authors

Name	Location	Contribution
James W. Wheless, BScPharm, MD, FAAP, FACP, FAAN, FAES	Pediatric Neurology, University of Tennessee Health Science Center; Neuroscience Institute & Le Bonheur Comprehensive Epilepsy Program, Le Bonheur Children's Hospital	Drafting/revision of the manuscript for content, including medical writing for content; major role in the acquisition of data; study concept or design; analysis or interpretation of data
Brooke Richardson, MS, CCC-SLP	The Modern MedSLP	Drafting/revision of the manuscript for content, including medical writing for content; major role in the acquisition of data; study concept or design; analysis or interpretation of data
Clio Rubinos, MD, MS	Neurocritical Care and Epilepsy, UNC School of Medicine	Drafting/revision of the manuscript for content, including medical writing for content; major role in the acquisition of data; study concept or design; analysis or interpretation of data
Raymond Faught, MD	Epilepsy Center, Emory Healthcare	Drafting/revision of the manuscript for content, including medical writing for content; major role in the acquisition of data; study concept or design; analysis or interpretation of data
Marry Vuong, PharmD, BCPPS	Department of Neurology and Neurosurgery, Nicklaus Children's Hospital	Drafting/revision of the manuscript for content, including medical writing for content; major role in the acquisition of data; study concept or design; analysis or interpretation of data

References

1. Rajati F, Ahmadi N, Naghibzadeh ZAS, Kazeminia M. The global prevalence of oropharyngeal dysphagia in different populations: a systematic review and meta-analysis. *J Transl Med.* 2022;20(1):175. doi:10.1186/s12967-022-03380-0
2. Wolf DC. Dysphagia. In: Walker HK, Hall WD, Hurst JW, eds. *Clinical Methods: The History, Physical, and Laboratory Examinations*. 3rd ed. Butterworths; 1990. Accessed October 24, 2023. ncbi.nlm.nih.gov/books/NBK408/
3. Sánchez-Sánchez E, Avellaneda-López Y, García-Marín E, Ramírez-Vargas G, Díaz-Jimenez J, Ordonez FJ. Knowledge and practice of health professionals in the management of dysphagia. *Int J Environ Res Public Health*. 2021;18(4):2139. doi:10.3390/ijerph18042139
4. Bolinger C, Dembowski J, Mory K. Pneumonia: does age or gender relate to the presence of an SLP dysphagia consultation? *Geriatrics*. 2020;5(3):51. doi:10.3390/geriatrics5030051
5. Wilkins T, Gillies RA, Thomas AM, Wagner PJ. The prevalence of dysphagia in primary care patients: a HamesNet Research Network Study. *J Am Board Fam Med.* 2007;20(2):144-150. doi:10.3122/jabfm.2007.02.060045
6. Al-aqeel S, Gershuni O, Al-sabhan J, Hiligsmann M. Strategies for improving adherence to antiepileptic drug treatment in people with epilepsy. *Cochrane Database Syst Rev* 2020;10(10):CD008312. doi:10.1002/14651858.CD008312.pub4
7. Leslie P, Smithard DG. Is dysphagia under diagnosed or is normal swallowing more variable than we think? Reported swallowing problems in people aged 18-65 years. *Dysphagia*. 2021;36(5):910-918. doi:10.1007/s00455-020-10213-z
8. Bendsen BB, Jensen D, Westmark S, Krarup AL, Riis J, Melgaard D. The quality of life in citizens with oropharyngeal dysphagia—a cross-sectional study. *J Clin Med.* 2022;11(14):4212. doi:10.3390/jcm11144212
9. Umay E, Eyigor S, Giray E, et al. Pediatric dysphagia overview: best practice recommendation study by multidisciplinary experts. *World J Pediatr.* 2022;18(11):715-724. doi:10.1007/s12519-022-00584-8
10. Shaker R. Oropharyngeal dysphagia. *Gastroenterol Hepatol (N Y)*. 2006;2(9):633-634.
11. MacQueen IT, Chen D. Chapter 22 - esophageal dysphagia. In: Chhetri DK, Dewan K, eds. *Dysphagia Evaluation and Management in Otolaryngology*. Elsevier; 2019:173-183. doi:10.1016/B978-0-323-56930-9.00022-X
12. Ogawa K, Kanemoto K, Ishii Y, et al. Long-term follow-up study of Lennox-Gastaut syndrome in patients with severe motor and intellectual disabilities: with special reference to the problem of dysphagia. *Seizure*. 2001;10(3):197-202. doi:10.1053/seiz.2000.0483
13. Stathopoulos P, Dalakas MC. Autoimmune neurogenic dysphagia. *Dysphagia*. 2022;37(3):473-487. doi:10.1007/s00455-021-10338-9
14. Hauser WA, Annegers JF, Kurland LT. Incidence of epilepsy and unprovoked seizures in Rochester, Minnesota: 1935-1984. *Epilepsia*. 1993;34(3):453-468. doi:10.1111/j.1528-1157.1993.tb02586.x
15. Tanaka A, Akamatsu N, Shouzaki T, et al. Clinical characteristics and treatment responses in new-onset epilepsy in the elderly. *Seizure*. 2013;22(9):772-775. doi:10.1016/j.seizure.2013.06.005
16. Brodie MJ, Elder AT, Kwan P. Epilepsy in later life. *Lancet Neurol.* 2009;8(11):1019-1030. doi:10.1016/S1474-4422(09)70240-6

17. Pugh MJV, Knoefel JE, Mortensen EM, Amuan ME, Berlowitz DR, Van Cott AC. New-onset epilepsy risk factors in older veterans. *J Am Geriatr Soc*. 2009;57(2):237-242. doi:10.1111/j.1532-5415.2008.02124.x
18. Dziewas R, Allescher HD, Aroyo I, et al. Diagnosis and treatment of neurogenic dysphagia—S1 guideline of the German Society of Neurology. *Neurol Res Pract*. 2021;3(1):23. doi:10.1186/s42466-021-00122-3
19. Franko D, Shapiro J, Gagne A. Phagophobia: a form of psychogenic dysphagia. A new entity. *Ann Otol Rhinol Laryngol*. 1997;106(4):286-290. doi:10.1177/000348949710600404
20. Bushuven S, Niebel I, Huber J, Diesener P. Emotional and psychological effects of dysphagia: validation of the jugendwerk dysphagia emotion and family assessment (JDEFA). *Dysphagia*. 2022;37(2):375-391. doi:10.1007/s00455-021-10289-1
21. Chilukuri P, Odufalu F, Hachem C. Dysphagia. *Mo Med*. 2018;115(3):206-210.
22. Ratuapli SK, Hansel SL, Umar SB, et al. Esophageal peristaltic defects in adults with functional dysphagia. *Dysphagia*. 2014;29(4):519-526. doi:10.1007/s00455-014-9540-y
23. Wilkinson JM, Codipilly DC, Wilfahrt RP. Dysphagia: evaluation and collaborative management. *Am Fam Physician*. 2021;103(2):97-106.
24. Ramsey RR, Zhang N, Modi AC. The stability and influence of barriers to medication adherence on seizure outcomes and adherence in children with epilepsy over 2 years. *J Pediatr Psychol*. 2018;43(2):122-132. doi:10.1093/jpepsy/jsx090
25. Modi AC, Wu YP, Guilfoyle SM, Glauser TA. Uninformed clinical decisions resulting from lack of adherence assessment in children with new-onset epilepsy. *Epilepsy Behav*. 2012;25(4):481-484. doi:10.1016/j.yebeh.2012.09.008
26. Modi AC, Rausch JR, Glauser TA. Early pediatric antiepileptic drug nonadherence is related to lower long-term seizure freedom. *Neurology*. 2014;82(8):671-673. doi:10.1212/WNL.0000000000000147
27. Birchall O, Bennett M, Lawson N, Cotton SM, Vogel AP. The role of instrumental swallowing assessment in adults in residential aged care homes: a national modified delphi survey examining beliefs and practices. *Dysphagia*. 2022;37(3):510-522. doi:10.1007/s00455-021-10296-2
28. Balou M, Herzberg EG, Kamelhar D, Molfenter SM. An intensive swallowing exercise protocol for improving swallowing physiology in older adults with radiographically confirmed dysphagia. *Clin Interv Aging*. 2019;14:283-288. doi:10.2147/CIA.S194723
29. Abdel Jalil AA, Katzka DA, Castell DO. Approach to the patient with dysphagia. *Am J Med*. 2015;128(10):1138.e17-23. doi:10.1016/j.amjmed.2015.04.026
30. Triggs J, Pandolfino J. Recent advances in dysphagia management. *F1000Res*. 2019;8:F1000 Faculty Rev-1527. doi:10.12688/f1000research.18900.1
31. McIntosh E. Dysphagia. *Home Healthc Now*. 2023;41(1):36-41. doi:10.1097/NHH.0000000000001134
32. Bohlender JE, Frick S, Colotto U, Hotzenköcherle S, Brockmann-Bauser M. [The German sydney swallow questionnaire: reliability and validity in patients with oropharyngeal dysphagia]. *HNO*. 2021;69(12):969-977. doi:10.1007/s00106-021-01000-9
33. McElhiney J, Lohse MR, Arora AS, et al. The Mayo dysphagia questionnaire-30: documentation of reliability and validity of a tool for interventional trials in adults with esophageal disease. *Dysphagia*. 2010;25(3):221-230. doi:10.1007/s00455-009-9246-8
34. Reedy EL, Herbert TL, Bonilha HS. Visualizing the esophagus during modified barium swallow studies: a systematic review. *Am J Speech Lang Pathol*. 2021;30(2):761-771. doi:10.1044/2020_AJSLP-20-00255
35. Blonski W, Kumar A, Feldman J, Richter JE. Timed barium swallow: diagnostic role and predictive value in untreated achalasia, esophagogastric junction outflow obstruction, and non-achalasia dysphagia. *Am J Gastroenterol*. 2018;113(2):196-203. doi:10.1038/ajg.2017.370
36. Pisegna JM, Langmore SE. Parameters of instrumental swallowing evaluations: describing a diagnostic dilemma. *Dysphagia*. 2016;31(3):462-472. doi:10.1007/s00455-016-9700-3
37. Liu LWC, Andrews CN, Armstrong D, et al. Clinical practice guidelines for the assessment of uninvestigated esophageal dysphagia. *J Can Assoc Gastroenterol*. 2018;1(1):5-19. doi:10.1093/jcag/gwx008
38. Steele SJ, Ennis SL, Dobler CC. Treatment burden associated with the intake of thickened fluids. *Breathe (Sheff)*. 2021;17(1):210003. doi:10.1183/20734735.0003-2021
39. Minshall S, Pownall S. Management of swallowing problems in community settings. *Br J Community Nurs*. 2019;24(7):323-327. doi:10.12968/bjcn.2019.24.7.323
40. Cichero JAY, Steele C, Duivestein J, et al. The need for international terminology and definitions for texture-modified foods and thickened liquids used in dysphagia management: foundations of a global initiative. *Curr Phys Med Rehabil Rep*. 2013;1(4):280-291. doi:10.1007/s40141-013-0024-z
41. Jahromi SR, Togha M, Fesharaki SH, et al. Gastrointestinal adverse effects of antiepileptic drugs in intractable epileptic patients. *Seizure*. 2011;20(4):343-346. doi:10.1016/j.seizure.2010.12.011
42. Aziz ZHA, Katas H, Omar MS, et al. Preference, perception, and acceptability of fluid gels as a potential age-appropriate dosage form for elderly patients with dysphagia. *Gels*. 2022;8(4):218. doi:10.3390/gels8040218
43. Cichero JA. Thickening agents used for dysphagia management: effect on bioavailability of water, medication and feelings of satiety. *Nutr J*. 2013;12:54. doi:10.1186/1475-2891-12-54
44. Carnaby-Mann G, Crary M. Pill swallowing by adults with dysphagia. *Arch Otolaryngol Head Neck Surg*. 2005;131(11):970-975. doi:10.1001/archotol.131.11.970
45. Schiele JT, Quinzler R, Klimm HD, Pruszydlo MG, Haefeli WE. Difficulties swallowing solid oral dosage forms in a general practice population: prevalence, causes, and relationship to dosage forms. *Eur J Clin Pharmacol*. 2013;69(4):937-948. doi:10.1007/s00228-012-1417-0
46. Blaszczyk A, Brandt N, Ashley J, Tuders N, Doles H, Stefanacci RG. Crushed tablet administration for patients with dysphagia and enteral feeding: challenges and considerations. *Drugs Aging*. 2023;40(10):895-907. doi:10.1007/s40266-023-01056-y
47. Tokhadze N, Chennell P, Bernard L, et al. Impact of alternative materials to plasticized PVC infusion tubings on drug sorption and plasticizer release. *Sci Rep*. 2019;9:18917. doi:10.1038/s41598-019-55113-x
48. Zerbib F, Roman S. Current therapeutic options for esophageal motor disorders as defined by the chicago classification. *J Clin Gastroenterol*. 2015;49(6):451-460. doi:10.1097/MCG.0000000000000317
49. Arnet I, Dietrich F, Rüegg S, Allemann SS. Non-adherence and epileptic emergency—reasons and solutions. *Clin Epileptol*. 2023;36:280-287. doi:10.1007/s10309-023-00627-8
50. Gudeman J, Jozwiakowski M, Chollet J, Randell M. Potential risks of pharmacy compounding. *Drugs R D*. 2013;13(1):1-8. doi:10.1007/s40268-013-0005-9
51. Hébuterne X, Vavricka SR, Thorne HC, MacKenzie-Smith L, Laoun R, Burisch J. Medication formulation preference of mild and moderate ulcerative colitis patients: a European survey. *Inflamm Intestinal Dis*. 2023;8(1):41-49. doi:10.1159/000530139
52. Johannessen Landmark C, Patsalos PN. Drug interactions involving the new second- and third-generation antiepileptic drugs. *Expert Rev Neurotherapeutics*. 2010;10(1):119-140. doi:10.1586/ern.09.136
53. LaPenna P, Tormoehlen LM. The pharmacology and toxicology of third-generation anticonvulsant drugs. *J Med Toxicol*. 2017;13(4):329-342. doi:10.1007/s13181-017-0626-4
54. Marvanova M Pharmacokinetic characteristics of antiepileptic drugs (AEDs). *Ment Health Clin*. 2016;6(1):8-20. doi:10.9740/mhc.2015.01.008
55. Vossler DG, Gidal BE. *A Summary of Antiseizure Medications Available in the United States: 2020 Update*. 2020. American Epilepsy Society. 2020.
56. *ZONISADE (Zonisamide) Oral Suspension 100 Mg/5 mL Package Insert*. Accessed August 1, 2022. accessdata.fda.gov/drugsatfda_docs/label/2006/020789s019lbl.pdf
57. Gidal BE, Resnick T, Smith MC, Wheless JW. Zonisamide: a comprehensive, updated review for the clinician. *Neurol Clin Pract*. 2024;14(1):e200210. doi:10.1212/CPJ.0000000000200210
58. *EPRONTIA (topiramate) oral Solution Package Insert*. 2023. Accessed November 17, 2023. eprontia.com/wp-content/uploads/2022/04/NDA-214679-EPRONTIA-PI_4-2022.pdf
59. *Anti-Epileptic Agents [Established Pharmacologic Class]*. National Institute of Health. Accessed November 17, 2023. dailymed.nlm.nih.gov/dailymed/search.cfm?labeltype=all&query=ANTI-EPILEPTIC+AGENT+%5BESTABLISHED+-PHARMACOLOGIC+CLASS%5D&pagesize=200&page=2
60. Aronson JK, ed. . In: *Meyler's Side Effects of Drugs (Sixteenth Edition)*. Elsevier; 2016:497-498. doi:10.1016/B978-0-444-53717-1.01471-2
61. White R, Bradnam V. *Handbook of Drug Administration via Enteral Feeding Tubes Third Edition*. Pharmaceutical Press; 2015. Accessed October 26, 2023. pharmaceutical-press.com/product/handbook-of-drug-administration-via-enteral-feeding-tubes-third-edition/
62. Jory C, Shankar R, Oak K, Oates J, Wilcock M. Going down the tubes! Impact on seizure control of antiepileptic medication given via percutaneous feeding tubes. *Epilepsy Behav*. 2017;74:114-118. doi:10.1016/j.yebeh.2017.06.024
63. Vuong M, González Aragón C, Montarroyos SS. Common food and drug interactions. *Pediatr In Rev*. 2023;44(2):68-80. doi:10.1542/pir.2022-005641
64. Thiyagalingam S, Kulinski AE, Thorsteinsdottir B, Shindelar KL, Takahashi PY. Dysphagia in older adults. *Mayo Clin Proc*. 2021;96(2):488-497. doi:10.1016/j.mayocp.2020.08.001
65. Takahashi K. [Xerostomia and dysphagia]. *Clin Calcium*. 2012;22(1):59-65.
66. Langmore SE, Terpenning MS, Schork A, et al. Predictors of aspiration pneumonia: how important is dysphagia? *Dysphagia*. 1998;13(2):69-81. doi:10.1007/PL00009559

How to cite this article: Wheless JW, Richardson B, Rubinos C, Faught R, Vuong M. Dysphagia in epilepsy patients: the silent enemy. *Neurol Clin Pract*. 2025;15(1):e200362. doi:10.1212/CPJ.0000000000200362.