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OBM Geriatrics

Review

Dysphagia in the Elderly, A Tough Issue to Swallow

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Academic Editor: Carlo Pedrolli

OBM Geriatrics
2025, volume 9, issue 2
doi:10.21926/obm.geriatr.2502309

Received: December 12, 2024
Accepted: April 21, 2025
Published: April 28, 2025

Abstract

Dysphagia in the geriatric population, age 65 or older, is increasingly common and a growing concern among healthcare providers. Not only can it critically impact quality of life, but it can also lead to clinically significant malnutrition, hospitalizations, increased length of stays, and has been shown to impact mortality. A multi-disciplinary approach to assess oral, pharyngeal, and esophageal etiologies is key to guiding targeted management, which can include behavioral modifications, medications, and endoscopic therapies. This review article will examine and summarize current knowledge on the etiopathogenesis, diagnosis and treatment options for elderly patients experiencing dysphagia.

Keywords

Swallowing; dysphagia; oropharyngeal; esophageal; upper esophageal sphincter; lower esophageal sphincter; motility; elderly; geriatric syndrome

1. Introduction

Dysphagia is defined as disordered or sensation of abnormal swallowing that occurs anywhere between the mouth and the lower esophageal sphincter. Dysphagia can have a significant impact on quality of life and overall health, especially in the elderly population, which is generally accepted as patients 65 years or older [1]. Dysphagia is considered a geriatric syndrome, due to its high prevalence in the elderly, multifactorial development, and association with morbidity and mortality [2]. While age-related physiologic changes in the esophagus termed presbyesophagus can impact swallowing through increased non-peristaltic contractions and delayed esophageal clearance, pathologic changes such as structural or functional diseases may exacerbate mild physiological dysmotility and lead to more profound dysphagia [1, 3, 4].

2. Epidemiology

Dysphagia affects an estimated 25% of adults living independently over the age of 50 years old. Up to 50% of nursing home residents and 50% of those with neurological disorders also suffer from dysphagia [1, 5, 6]. The etiology of dysphagia is multifactorial and includes being older than 74 years, male, taking longer than twenty minutes to finish a meal, meal consistency specifically solids, low BMI, and poor functional status [5]. The burden of dysphagia may be much more extensive than currently estimated. It is believed that the burden of dysphagia is underestimated as several people with milder symptoms adapt to through behavioral changes such as changing what they eat, drinking water with food or eating slower or experience silent aspiration [7]. Dysphagia can result in significant morbidities such as aspiration pneumonia, gastroesophageal reflux disease (GERD), malnutrition, and frailty, all of which can impair one’s quality of life and some of which can be potentially fatal. Swallowing dysfunction is associated with longer length of hospital stay, inpatient mortality, and higher healthcare costs [8, 9]. A study analyzing the prevalence of dysphagia in US inpatients found that a dysphagia diagnosis increased inpatient mortality among adult patients by 1.7 times (95% CI 1.67-1.74) and raised hospitalization costs by an average of $6,243 per patient. Patients with dysphagia had longer hospital stays, with an average of 6.6 days compared to 4.5 days for those without dysphagia [9].

3. Normal Swallowing Physiology

Normal swallowing (deglutition) involves an intricate sequence of voluntary and autonomic neuromuscular events that transfers a food bolus from the mouth through the pharynx and esophagus into the stomach (Figure 1). Swallowing has been described in three stages, accounting for the location of the bolus [10, 11]. The first stage is the voluntary oral phase. Solid food is masticated (chewed) and mixed with saliva to form a soft bolus that is easier to swallow. The bolus is compressed against the palate and pushed from the mouth into the oropharynx by the muscles of the tongue and soft palate [10]. The second stage describes an involuntary, rapid pharyngeal phase. It allows for food passage as the pharynx widens and shortens to receive the bolus of food. Relaxation of the upper esophageal sphincter (UES) via the cricopharyngeus and the thyropharyngeus muscles is necessary to allow the bolus to safely enter the esophagus. The pharyngeal phase also protects the airway by sealing off the nasopharynx and the laryngopharynx from the oropharynx. The suprahyoid muscles and longitudinal pharyngeal muscles contract, elevating the larynx and moving it forward while the epiglottis folds over the glottis to prevent food or liquid from entering the trachea [12, 13]. The third stage of normal swallowing is the involuntary, esophageal phase, which involves the sequential contraction of all three pharyngeal constrictor muscles from top to bottom to create a peristaltic ridge that forces the food bolus downwards into the esophagus. The upper third of the esophagus is composed largely of striated muscle while the lower two-thirds of the esophagus is composed of smooth muscle under autonomic control [12]. The lower esophageal sphincter (LES) relaxes to allow passage of the bolus into the stomach.

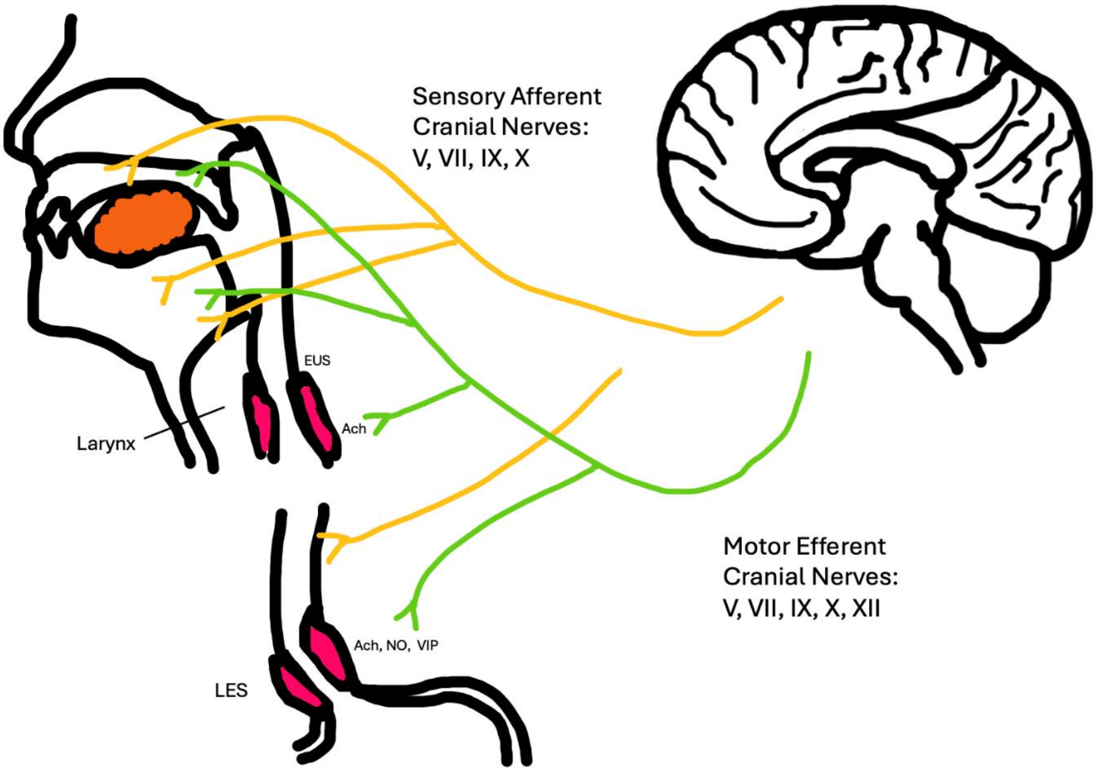

Figure 1 UES: upper esophageal sphincter; LES: Lower esophageal sphincter; Ach: Acetylcholine; NO: nitric oxide, VIP: vasoactive intestinal peptide.

Neurological control of swallowing is central to the coordination of its phases and relies on both central and peripheral nervous system pathways. The vagus nerve (CN X) contributes both afferent (sensory) and efferent (motor) fibers to the swallowing reflex. Afferent vagal fibers transmit sensory input from mechanoreceptors and chemoreceptors in the pharynx, larynx, and esophagus to the nucleus tractus solitarius (NTS) in the medulla, allowing the brainstem to monitor bolus size, consistency, and position [14]. Additional afferent inputs to the NTS come from the glossopharyngeal nerve (CN IX) and the trigeminal nerve (CN V). Efferent fibers from the nucleus ambiguus and dorsal vagal nucleus innervate the striated muscles of the pharynx and esophagus, as well as smooth muscle and sphincters, mediating their contraction and relaxation [14]. CN VII also plays a role in the oral phase as it afferent taste inputs come from the anterior tongue, which helps in coordinate food bolus. Its efferent motor neurons control the coordination of the buccinator muscles, which helps keep lips closed during swallowing and with posteriosuperior hyoid bone movement and elevation of the tongue during initiation of swallowing. It also contains parasympathetic neurons responsible for the salivary glands and dysfunction can lead to decreased saliva expression [15].

Control of the upper esophageal sphincter (UES) is complex. The major contributor to UES coordination is the cricopharyngeal muscle that receives its motor innervation through the pharyngoesophageal and superior laryngeal nerve, which are branches of the vagus nerve, whose nucleii are primarily located in the nucleus ambiguus as well as the thyropharyngeus. Tone and coordination are mediated by multiple reflexes including the vago-vagal and glossopharyngo-vagal reflexes [16, 17]. Excitatory neurotransmitters like acetylcholine are released at neuromuscular junctions to stimulate tonic contraction of the striated muscles in the upper esophagus and pharynx. Relaxation of the UES is facilitated by inhibition of the cricopharyngeal muscles via the pharyngeal plexus and recurrent laryngeal nerve as well as elevation of the hyoid bone and larynx and pressure from the bolus itself [16, 18, 19].

Control of the LES is mediated by the vagal pathway whose nuclei are found in the dorsal motor nucleus of the vagus [20]. The caudal dorsal motor nucleus is responsible for relaxation, while the rostral dorsal motor nucleus is responsible for contraction. Excitatory neurotransmitter acetylcholine signals for LES contraction [20-24]. Inhibitory neurotransmitters such as nitric oxide and vasoactive intestinal peptide (VIP) are released to relax the lower esophageal sphincter (LES) during bolus passage [25]. Vagal afferents relay secondary feedback to fine-tune the peristaltic waves and adjust sphincter tone in real-time. Dysfunction of this system, such as impaired afferent signaling or efferent motor output, can result in dysphagia.

4. Etiology

There are several ways in which dysphagia can be classified. A commonly accepted paradigm that is used is dividing by anatomical location and then further dividing into mechanical pathology and neuromuscular pathology (Table 1). Anatomical locations are typically defined as oral, pharyngeal, and esophageal. Typically, the oral and pharyngeal stages are combined together and include any disorder above the UES. The esophageal stage occurs anywhere between the UES and LES. Immunologic causes (such as eosinophilic esophagitis (EoE) and inflammatory myopathies) affect middle aged individuals, while neurologic and oncologic etiologies are most often seen in those older than 60 years old [16].

Table 1 Etiology of common causes of dysphagia by anatomical location. EGJOO: Esophagogastric junction outflow obstruction.

Oral	Pharyngeal	Esophageal
Poor dentation/Dental caries	Zenker's diverticulum	Peptic stricture
Poorly fitting dentures	Cricopharyngeal bar	Pill esophagitis
Xerostomia (due to polypharmacy, radiation, etc.)	Cervical webs, ring, stenosis	Eosinophilic/Lymphocytic esophagitis
Oral ulcers (due to dentures, recurrent aphthous stomatitis, etc.)	Cervical osteophytes	Rings, webs, and diverticula
Lichen Planus	Thyroiditis/Goiter	Achalasia/EGJOO
Infection		
Auto-immune disease (Sjogren's, Scleroderma, etc.)/Myasthenia Gravis		
Parkinson Disease/Advanced Dementia/Other Neuro-degenerative disorders		
Malignancy		

Post-Radiation
Stroke
Sarcopenia
Medications

When thinking about mechanical pathology during each phase of swallowing, it's helpful to evaluate if there is an intra- or extra-luminal component. Intraluminal pathologies can include strictures, webs, rings, tumors, as well as diverticulum/Zenker's. Extraluminal pathologies can include osteophytes, goiters, tumors, and vascular pathologies. In addition to this classical way of thinking about the mechanical etiologies of dysphagia, it is also important, especially in the elderly, to evaluate for dysfunction of bolus formation. This would include insufficient mastication (e.g. dental issues) and hyposalivation, which commonly can be due to medications, tobacco or alcohol use but can also be seen in inflammatory disorders such as Sjogren's [26-28].

When evaluating for neuromuscular pathologies it can be useful to evaluate for primary neurologic disorder causing muscular and peristaltic dysfunction. Common causes of primary neurologic disorders leading to dysphagia in the elderly are stroke, dementia (Alzheimer's, vascular, etc.), and Parkinson's disease [7, 26, 27]. Common non- neurologic disorders among the elderly causing dysphagia include gastroesophageal reflux disease, pill induced esophagitis, infections such as candidiasis and herpes simplex, and primary motility disorders such as achalasia, ineffective esophageal motility, and hypercontractile esophagus [26-29].

An important and often overlooked cause of non-neurologic etiology of dysphagia in the elderly is sarcopenic dysphagia. The etiology of sarcopenia itself is broad, and its discussion is beyond the scope of this article, but important factors associated are age, physical inactivity, malnutrition, and burden of comorbidities [30]. Sarcopenia has a strong association with dysphagia. In a meta-analysis by Zhoa et al., they found an odds ratio of 4.09 between sarcopenia and dysphagia [31]. Its prevalence varies based on population evaluated. For example, in evaluating the prevalence of sarcopenia in the community studies estimate that around 5.9-26% have sarcopenia associated dysphagia. One study found that around 32% of elderly patients referred to dysphagia rehab have a component of sarcopenic dysphagia [32-34]. Sarcopenia can lead to atrophy of the muscles associated with swallowing and has been shown to affect generation of tongue pressure required for proper bolus propagation, laryngeal elevation and pharyngeal contraction that can lead to prolonged pharyngeal transit, and upper esophageal sphincter dysfunction [35-37].

A less common but important etiology of dysphagia among the elderly is cervical muscular tension. This is defined by excessive anterior cervical muscle tone and can affect hyoid bone depression and dyscoordination of laryngeal muscles leading to dysphonia and dysphagia [38-40]. Cervical muscle tension most commonly affects patients who have had prior head and neck cancer, muscle tension dysphonia, cervical spine injuries, and postural disorders [38-41]. Additional factors contributing to cervical muscle tension include patients with vestibular deficits can have increased neck muscle tension to compensate for neck position stabilization [42].

Lastly, iatrogenic causes including polypharmacy in the elderly can lead to or contribute significantly to dysphagia. Several medications commonly prescribed to the elderly can increase the risk of dysphagia and thus thorough medication evaluation is critical to help diminish the risk. Some of the most commonly prescribed medications include antipsychotics which can induce extrapyramidal symptoms causing motor disturbances, as well as cause anti-histaminic and anticholinergic effects [43, 44]. Opioids can lead to both oropharyngeal dysphagia and esophageal motility disorders [45]. Benzodiazepines can increase the risk of dysphagia through centrally mediated mechanisms via impaired oropharyngeal coordination [45]. Anti-depressants can lead to dysphagia via anticholinergic effects and cognitive impairment [45, 46]. Beta-blockers have been shown to increase the risk of dysphagia [45]. Additionally, multiple medications can cause xerostomia which can interfere with swallowing. These commonly include ACE inhibitors, anti-emetics (such as scopolamine, diphenhydramine, promethazine, and prochlorperazine), calcium channel blockers, and diuretics [47].

5. Evaluation

5.1 History and Physical Exam

Workup for dysphagia should start with a detailed history and focused physical exam. This should guide investigations which include radiographic work up, endoscopy, and manometry (Figure 2). Patients with dysphagia may present with a variety of complaints, commonly difficulty with swallowing food or liquid, choking or coughing during or after swallowing, sensation of food getting stuck [28, 48, 49]. Many of those affected are unaware of their symptoms, making it crucial for providers to recognize populations at risk for swallowing disorders. A careful history includes the nature of the swallowing impairment, onset and course, and whether symptoms occur with liquids, solids, or both to determine the etiology of the disorder. The history should be able to guide the differential. Dysphagia to liquids only or to solids and liquids with difficulty initiating a swallow would suggest an oropharyngeal pathology, while dysphagia to just solids, progression of solids then liquids, or intermittent solids or liquid dysphagia would suggest an esophageal pathology. Additional specific questions about associated symptoms can narrow the differential diagnosis, including coughing during meals, choking, drooling, regurgitation, heartburn or chest pain, voice changes, and weight loss [28, 48, 49].

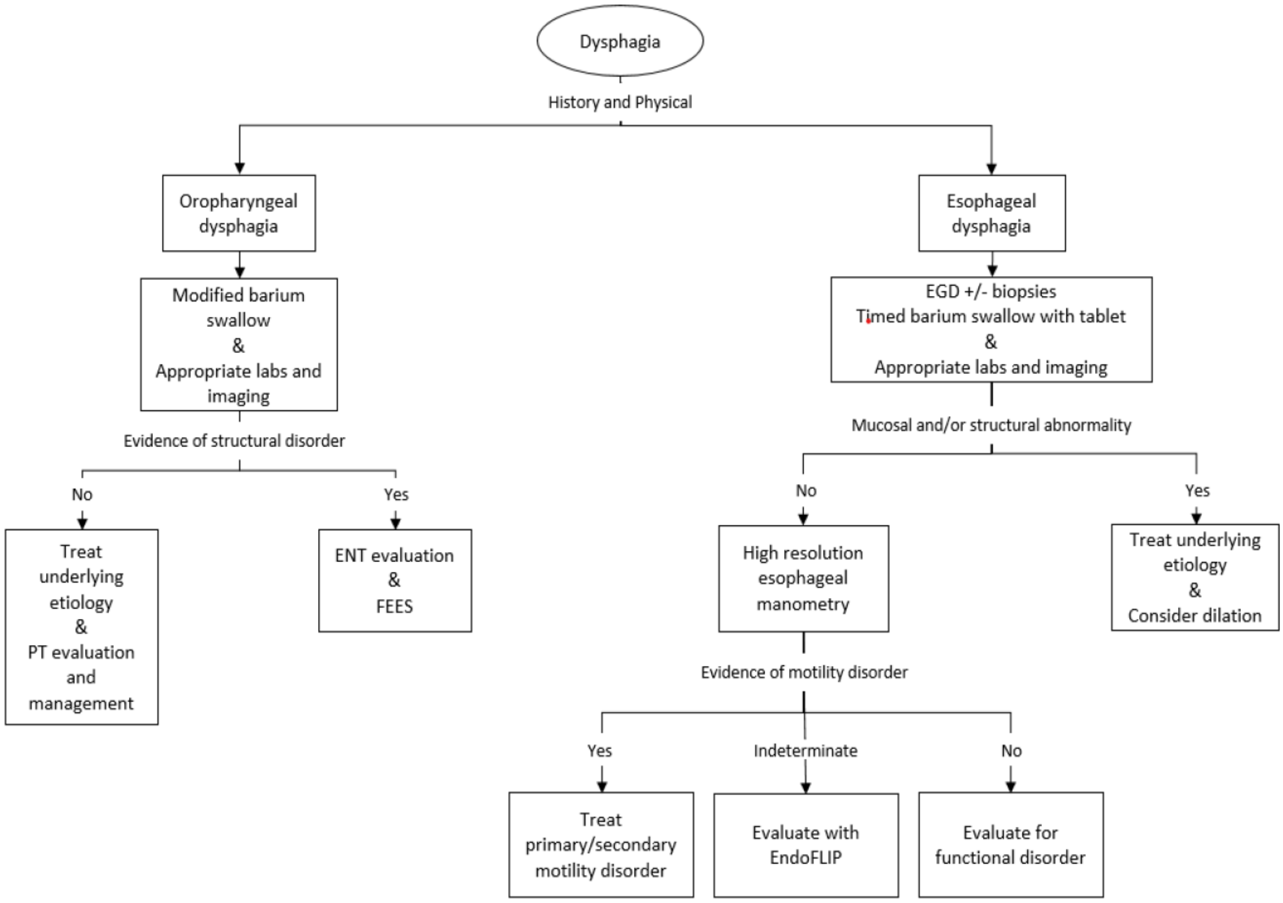

Figure 2 Evaluation of dysphagia. FEES: fiberoptic endoscopic evaluation of swallowing.

It is important to ask about prior alcohol use, tobacco use, and other social factors such as drug use. Additionally, it is important to perform a thorough review of the patient's current medications to identify the presence of side-effects that lead to dysphagia [48, 49]. For example, a variety of medications have been associated with esophageal mucosal injury, reduced LES tone and reflux, and xerostomia [50]. Personal medical history and surgical history looking for factors that can lead to or be associated with dysphagia such as thyroid disease, autoimmune diseases, or prior cancer history as well as the treatment the patient underwent can help provide clues to the etiology of their dysphagia. The provider should also obtain a detailed family history to assess the presence or risk of neurologic disorders, head and neck cancers, or pre-cancerous conditions like Barretts esophagus.

A comprehensive physical exam serves to identify any potential anatomic or physiologic abnormalities that can contribute to the development of dysphagia. A neurological exam should be conducted to test cranial nerve function, motor and sensory function, and reflexes. The provider should pay close attention to the cranial nerves implicated in swallowing dysfunction, including motor fibers supplied by V, VII, IX, X and XII and sensory fibers from V, VII, IX and X. The afferent and efferent limbs of the gag reflex are supplied by cranial nerves IX and X respectively. A decreased gag reflex is associated with an increased risk of aspiration [48]. A thorough head and neck exam should be conducted, which includes inspection of the jaw, teeth, lips, soft palate, and tonsils for lesions or obstructions, and palpation of the thyroid gland to rule out extrinsic compression of the esophagus. A bedside swallow study can be conducted to directly observe the patient's swallowing function.

The patient should demonstrate effective mastication, enabling the breakdown of food to form an adequate bolus, which should then be transferred into the pharynx and esophagus without signs of choking or coughing. Inspection, palpation, and auscultation of the abdominal region can identify masses, distention, tenderness, obstruction, or prior surgical scars that may suggest potential etiology of their swallowing symptoms. Finally, a lung auscultation should be performed to assess for aspiration.

5.2 Oropharyngeal Dysphagia

Patients at high risk for aspiration may benefit from a water swallow test for initial screening [7, 51]. This is a quick bedside procedure where patients swallow between 1 to 5 mL of water to gauge aspiration risk such as airway response through cough/choke or voice change. This was found to be 71% sensitive (95% CI, 63-78%) and 90% specific for detecting aspiration (95% CI, 86%-93%) in a 2016 systematic review and meta-analysis [7, 52]. If oropharyngeal dysphagia is suspected based on clinical exam or bedside swallow evaluation, further evaluation is needed to better understand the specific structural or physiologic etiology to swallowing impairment. Two main imaging assessments include the videofluoroscopic swallow study and the fiberoptic endoscopic evaluation of swallowing.

5.2.1 Videofluoroscopy Swallowing Study (VFSS)

The gold standard for diagnosis of oropharyngeal dysphagia is the Videofluoroscopy Swallowing Study, also known as the modified barium swallow study [4, 7, 51]. This imaging study consists of swallowing barium or water-soluble contrast in different viscosities as well as foods mixed or coated with contrast with simultaneous radiologic video recordings in the lateral and anterior-posterior view of the swallowing to allow accurate measurement of the oropharyngeal swallow response to various volumes, viscosities, and food textures. This helps to evaluate aspiration measured on the penetration aspiration scale and whether this occurs before, during, or after swallowing. Furthermore, this imaging study provides a clear view of impaired bolus formation and propulsion, ineffective swallow or delayed/uncoordinated swallow response, or impaired opening of the upper esophageal sphincter [4].

5.2.2 Fiberoptic Endoscopic Evaluation of Swallowing (FEES)

The FEES, which can be done if VFSS is not available, includes three parts [4, 51]. First, an endoscope is inserted through one nostril to directly visualize the anatomy related to swallowing, secretions in the hypopharynx and larynx, and movement of key structures including base of tongue retraction and glottis closure. Second, small amounts of liquid and solids of varying bolus sizes and consistencies are provided to the patient to directly observe their swallowing. This helps to evaluate bolus preparation and propulsion and pharyngeal clearance as well as whether penetration occurred using the same penetration aspiration scale score used for VFSS [4]. Third, the dysphagia-trained therapist can observe the effectiveness of a variety of therapeutic maneuvers such as chin tuck [4, 7].

Both VFSS and FEES are used for diagnosis and for therapeutic purposes by guiding behavioral strategies or bolus alterations. FEES has some advantages in that it can be done at bedside, can be continued for a prolonged period as no barium is used, and can be used in biofeedback mode to give real instructions and education to the patient and family on various swallowing techniques. Furthermore, FEES is a better test in severely dysphagic patients who have not eaten orally for weeks and have less reserve muscle strength for swallowing as multiple bolus trials are given and, therefore, there is potential for recovery and improved swallowing throughout the course of the study [4]. A 2016 systematic review and meta-analysis of the accuracy of VFSS and FEES in assessing oropharyngeal dysphagia found that FEES had higher sensitivity for detecting aspiration (0.88 vs 0.77; p = 0.03) compared to VFSS; although specificity of both tests were similar (range 0.93-0.98) [7, 53].

5.3 Esophageal Dysphagia

5.3.1 Esophagogastroduodenoscopy

The main form of diagnosis of esophageal dysphagia is esophagogastroduodenoscopy (EGD) [7, 54]. EGD provides direct visualization of the esophagus which can rule out structural etiologies and provides an opportunity for biopsies to diagnosed other conditions that may be too early to visualize such as eosinophilic esophagitis [54]. This test not only serves as a diagnostic tool but also provides an opportunity for management and therapy such as dilation of strictures.

However, one of the major risks of EGD is aspiration, particularly in the elderly adult population who are already at increased risk of aspiration. Other risks in the elderly include hypotension and hypoxia which are associated with sedation and tend to be transient. EGD both with and without sedation have both been found to be relatively safe in the elderly with one study finding similar GI and non-GI complication rates, except for acute myocardial infarction rates which were significantly higher in EGD without sedation [55]. Overall, while aspiration events are very rare, it was found that retained food and use of monitored anesthesia care or general anesthesia substantially increased odds of aspiration. Similarly, other unplanned cardiopulmonary events were also found to be increased in patients receiving deep sedation with propofol [56, 57]. Efforts to minimize risk of aspiration during the procedure include avoiding excess sedation, suctioning insufflated gastric air after the procedure, and preforming the procedure in a time efficient manner [7, 58].

Despite the risks, EGD is still relatively safe and carries a high diagnostic value in the elderly population, particularly given the high prevalence of abnormal endoscopic findings. An analysis of a major database estimated that only approximately twenty nine percent of elderly patients who underwent endoscopy had normal endoscopy findings [54, 55, 59, 60].

5.3.2 Esophageal High-Resolution Manometry

In patients with no obstructive etiology confirmed on EGD with normal biopsies, the next recommended test per ACG guidelines is esophageal high-resolution manometry (HRM) which is considered the gold standard for diagnosis of motility disorders [54, 61, 62]. The standard protocol for this test involves 10 supine and five upright test swallows, however some provocative maneuvers such as multiple rapid swallows, rapid drink challenge, and/or a standardized test meal improves diagnostic yield. During this test, pressure recordings extracted from closely spaced circumferential sensors on a catheter which is then assimilated and displayed as 3-dimensional pressure topography using dedicated software [61].

In patients with equivocal results for esophagogastric junction outflow obstruction (EGJOO) on HRM, one should consider further testing with a timed barium esophagram (TBE) or functional lumen imaging probe (FLIP) [54].

5.3.3 Timed Barium Esophagram

TBE can be considered for several indications; 1) an alternative test to HRM given its availability at most institutes, 2) elderly patients at high risk for EGD, or 3) as the next step in testing in patients who have equivocal results on prior tests such as HRM [54, 61]. In one study evaluating the accuracy of TBE, when compared to diagnosis of achalasia or EGJOO on HRM and FLIP, it was found that TBE correlated well (sensitivity 77.8% and specificity 86.0%) [63]. The timed upright barium esophagram involves swallowing 8 oz or 236 mL of barium and evaluating barium height at 1 minute (abnormal when >5 cm) and 5 minutes (abnormal when >2 cm). This assesses esophageal bolus transit and can evaluate abnormal esophageal emptying to assess for motility disorders such as achalasia and to evaluate the anatomic relationship at the esophagogastric junction to assess for other esophageal outflow obstructions [55, 61]. A 13 mm barium tablet can be added to the study to evaluate obstructive esophageal symptoms (abnormal if tablet retained after 5 minutes) as when both liquid and barium tablets are used, this increases the diagnostic yield in one study, though more evidence is needed [61, 64].

5.3.4 Functional Lumen Imaging Probe

FLIP can be considered for similar indications as TBE under the Chicago classification [54, 62]. This test uses multiple closely spaced impedance planimetry channels within a distensible bag to simultaneously measure luminal diameters and intra-bag pressure during controlled volumetric distension allowing for visualization of multiple properties not seen on HRM such as response to esophageal distention and nonocclusive esophageal contractions [54, 61, 65]. By measuring EGJ distensibility, it can diagnose achalasia in patients with monometrically normal EGJ relaxation [61, 66]. Unfortunately, this test is not widely available in clinical practice given a lack of data and standardized protocols [61].

6. Management

6.1 Oropharyngeal Dysphagia – Motor Disorders

6.1.1 Postural Techniques

Postural techniques are easy yet effective interventions to facilitate swallowing in oropharyngeal (OP) dysphagia. Eating should be done in an upright position [67]. Anterior neck flexion (chin tuck) helps protect the airway during swallow [68]. Meanwhile, posterior neck flexion helps promote gravitational pharyngeal drainage [68]. In hemiplegic stroke patients, head rotation towards the paralyzed pharyngeal side during swallow directs food to the healthy side. Meanwhile, head tilt to the stronger side prior to swallow is thought to use gravity to direct the bolus down to the stronger side [51].

6.1.2 Dietary Modifications

Dietary modifications incorporate important strategies to reduce the risk of aspiration in elderly patients with dysphagia. Reductions in bolus volume and avoiding distractions while eating are simple tactics that can be used to optimize swallowing. Single textured foods have also been shown to be easier to swallow [67]. Increasing bolus viscosity with thickening agents such as xantham gum and modified starch have consistently shown to decrease aspiration risk; however, patients often struggle with compliance of thickening agents due to issues with unpalatability [69]. Notably, the International Dysphagia Diet Standardization Initiative (IDDSI) developed a standard framework to describe texture modified foods and thickened liquids for individuals with swallowing difficulties using a continuum of eight levels [70]. This framework has been widely accepted in hospitals and industry due to its practicality and clear definitions [71, 72]. The degrees of modification in the IDDSI descriptors, which reflects homogeneity of particles and particle size, can help to guide choice of diet in elderly patients with dysphagia and risk of aspiration [73].

6.1.3 Rehabilitation and Therapy

Various exercise and rehabilitation programs are commonly used for disordered swallowing. Common exercise programs include effortful swallow therapy which aims to reduce food residue in the valleculae, and super- and supra- glottic maneuvers which aim to close the airways before and during swallow [67]. Other frequently used exercises include the Shaker, Masako, and Mendelson exercises as well as the McNeill Dysphagia Therapy Program [67]. Lingual exercises are thought to improve oropharyngeal performance of bolus clearance [74].

6.1.4 Oral Hygiene

Poor oral health is more common in the elderly, but particularly in those with oropharyngeal dysphagia [75]. Studies have suggested that oral and dental health are important factors in the risk of aspiration pneumonia in the elderly [76]. Therefore, basic oral care and routine dental checkups should be foundational in the management of dysphagia in elderly patients.

6.1.5 Pharmacologic Management

First and foremost, it is important to limit drugs that have been associated with impaired swallowing such as benzodiazepines, ethanol, and neuroleptic medications like haloperidol and phenothiazines, particularly in the elderly [51]. While some studies have shown some promising data around the use of pharmacologic agents to improve swallow, none are consistently used in clinical practice at this time; the data around the efficacy of these interventions in the elderly is even further limited. For example, black pepper oil, capsaicin, and angiotensin converting enzyme inhibitors (ACEi) have been theorized to improve swallowing through increase in the concentration of Substance P, which acts as a neurotransmitter for the swallow response [53]. Capsaicin and piperine act as TRPV1 agonists and increase sensory stimulation of the swallowing pathway [69]. Activation of dopaminergic neurons through L-dopa or dopamine agonists like amantadine may also help to reduce dysphagia [51].

Botulinum (BTX) injection is a nonsurgical treatment alternative that is successfully used for upper esophageal sphincter (UES) hypercontractility. BTX can be applied endoscopically or percutaneously. Although retreatment is typically needed, studies have shown long-lasting relief of symptoms with BTX treatment. This has been shown to be a viable alternative to cricopharyngeal (CP) myotomy and can be a reasonable consideration for elderly patients seeking a less invasive treatment option for UES hyperfunction [77].

6.2 Oropharyngeal Dysphagia – Mechanical Disorders

Mechanical disorders leading to OP dysphagia are less common but can still be clinically significant causes for dysphagia in the elderly.

6.2.1 Cricopharyngeal Bar

Cricopharyngeal is a relatively common finding in elderly individuals with and without dysphagia [78]. CP myotomy, which can be performed either open or endoscopically can provide effective symptom relief. Esophageal dilation can be an adequate alternative to surgery, particularly for elderly patients with poor functional status who may not be surgical candidates [79]. Notably, some studies favor Savary dilation in elderly patients for the dilation of CP bar due to its safety profile and ease of endoscopic dilation [80].

6.2.2 Cervical Osteophyte-Associated Dysphagia

Cervical osteophytosis is commonly found in the elderly and often asymptomatic. In the small percentage of patients that do present with dysphagia, initial management includes conservative strategies such as diet modifications and postural changes [81]. Medical management can include anti-reflux medications and steroids. If conservative management fails and the patient is a good surgical candidate, surgical decompression should be considered via osteophytectomy, as studies show a high efficacy rate [81].

6.2.3 Zenker's Diverticulum

Definitive management for symptomatic Zenker's diverticulum involves diverticulectomy with or without CP myotomy. Multiple factors affect the decision to pursue an open or endoscopic approach, including size of diverticulum and prior history of neck surgery [82]. While open diverticulectomy has been associated with higher complication rates, endoscopic diverticulectomy has been shown to have higher rates of failure compared to an open approach [83]. Overall, an endoscopic approach may be more favorable for elderly patients. Studies have generally shown surgical correction of symptomatic Zenker's diverticulum to be a safe and effective procedure in the elderly that often results in major improvements to quality of life [84].

6.3 Esophageal Dysphagia – Motor Disorders

6.3.1 Lifestyle Modifications

Similarly to oropharyngeal dysphagia, lifestyle modifications are an important component of the management of various etiologies of esophageal dysphagia. Positional changes such as eating upright can reduce dysphagia related to gastroesophageal reflux disease. Avoiding spicy or acidic foods, coffee, chocolate, or alcohol can reduce esophageal exposure to acid [85]. An elimination diet can be effective in reducing histopathologic signs and esophageal symptoms such as dysphagia in adult patients with eosinophilic esophagitis [86].

6.3.2 Pharmacologic Management

Various pharmacologic agents are utilized in the management of esophageal dysphagia related to motor disorders. For hypercontractile disorders, there are several types of pharmacologic therapies available. For example, nitrates, calcium channel blockers (CCB), anticholinergics, and tricyclic antidepressants (TCA) can be used for esophageal motility disorders such as EGJ outflow obstruction, jackhammer esophagus, or diffuse esophageal spasms [87]. Calcium channel antagonists reduce esophageal contraction via smooth muscle relaxation and can be effective in spastic disorders of the esophagus [67]. Neuromodulators such as TCA similarly also relax smooth muscle, but their adverse event profile can make them unfavorable in the elderly [88]. Additionally, hyoscyamine, a muscarinic receptor antagonist, has been used as an off-label adjuvant for spastic esophageal disorders and functional heartburn [89, 90]. In the management of ineffective esophageal motility (IEM) there are also multiple treatment options. Bethanechol, a muscarinic receptor agonist, has been shown to improve esophageal dysfunction by increasing esophageal contraction pressure and bolus time [91, 92]. Buspirone, a 5-HT_{1A} receptor agonist, has been shown to increase esophageal peristaltic amplitude and increase resting LES pressures and has been used for IEM, GERD and functional dysphagia and heartburn [93-95]. Lastly, prucalopride, a 5-HT_4 receptor agonist, has been used off label for the treatment of IEM as it has been shown to improve both primary and secondary peristalsis, however, its primary use is in chronic constipation and improved gastric motility [96-98]. Additionally, it is important to consider the impact of opioids on esophageal motility. If a patient is on chronic opioids then a trial of peripheral acting opioid antagonist should be trialed, as it has shown to provide some improvement in esophageal dysphagia symptoms [99].

Proton pump inhibitors (PPI) are a mainstay treatment of GERD and EoE. The overall quality of evidence on adverse events related to PPIs is low, and so if there is a clear indication for chronic PPI, it is reasonable for long term use in the elderly [100]. Topical steroids are another effective pharmacologic agent for EoE, though there are no trials studying effects in elderly populations specifically [101]. Finally, Dupilumab (Dupixent) is a human monoclonal antibody which has been shown to improve histologic outcomes and symptoms of EoE and is FDA-approved for the treatment of EoE [102]. The data around Dupilumab for EoE in elderly populations specifically is lacking. However, studies have shown Dupilumab to be an effective and safe therapy for older patients in other inflammatory conditions like atopic dermatitis [103].

6.3.3 Endoscopic and Surgical Interventions

There are various surgical and endoscopic interventions that can be effective for the management of esophageal motor disorders. Endoscopic pneumatic balloon dilation uses a catheter passed balloon to disrupt the muscle fibers of the LES and is a generally safe and effective treatment option for achalasia. However, some studies have suggested older age, in addition to larger balloon size to be risk factors for perforation [104]. EsoFLIP (Medtronic, Minneapolis, MN, USA) is a newer technology which integrates impedance planimetry measurements with balloon dilation to allow real-time visualization and objective measurement during therapeutic dilation [105]. Though data is still emerging, initial studies show EsoFLIP to be a safe and effective therapeutic option for achalasia, EGJOO [106]. However, studies on EsoFLIP in elderly populations are limited. Similar to its use in UES hypercontractility, endoscopic botulinum toxin injection into the LES can be an effective and less invasive option to treat achalasia [88]. While less invasive than other treatment options, the effect of injections wanes with time and can necessitate repeat endoscopy, leading to higher overall costs compared to endoscopic dilations [107].

Laparoscopic heller myotomy is a minimally invasive surgical procedure which relieves pressure of the LES; studies show similar rates of success regardless of age in elderly patients with an acceptable surgical risk [108]. Peroral endoscopic myotomy (POEM) is an even less invasive intervention than heller myotomy with similarly high rates of clinical success. Multiple studies have shown it to have similar rates of efficacy and complications amongst elderly individuals compared to younger populations [109, 110]. Lastly, laparoscopic Nissen fundoplication, which wraps the fundus around the esophagus to reinforce the LES is an effective maneuver in the treatment of refractory GERD. While not extensively studied in elderly patients, published studies suggest that age does not affect short and long-term outcomes after the procedure [111, 112].

6.4 Esophageal Dysphagia – Mechanical Disorders

Esophageal dilation is an important intervention for dysphagia related to esophageal strictures. Dilations should be done gradually and often over several sessions, with no more than three bougie dilators of sequential size be passed once moderate resistance is reached to reduce risk of perforation [113]. Esophageal dilation is usually safe and effective for conditions like esophageal web, benign strictures, and rings, which are more common in the elderly [113]. While there are numerous tools for the use of dilation, when comparing Maloney, balloon, and Savary dilators, perforation was most seen with the blind passage of Maloney dilators [114]. In general, studies have not shown major differences in the efficacy or complication rates between Savary and balloon dilators [80]. Concurrent injection of intra-stricture steroids, typically triamcinolone acetodine dosed at 40 mg/ml with 0.5 ml injected per quadrant, can also lengthen the time to repeat dilation and improve symptom remission and reduce the number of invasive procedures needed in elderly patients [87].

Esophageal stents are effective tools for recurrent strictures or esophageal malignancy. While stenting can be done almost throughout the esophagus, it is generally avoided at the UES and placement is recommended at least 2 cm below the UES. This is due to significant adverse effects which include pain, increase risk of food impaction, tracheoesophageal fistula formation, and aspiration pneumonia [115, 116]. In the setting of cancer management, esophageal stents are primarily used as a palliative measure to improve PO intake and nutrition [117]. Studies have shown self-expandable metal stents (SEMS) to be effective in alleviating dysphagia in frail patients who were not candidates for cancer-directed therapy [118]. Additionally, while esophageal stents are a viable treatment modality for benign esophageal stenosis, they are not typically recommended for first line treatment based on international endoscopic society guidelines [116, 119, 120]. Esophageal stenting has high risk of stent migration, can cause symptoms of chest pain and dysphagia, as well as are at risk of obstruction and fistula development [116, 121, 122]. However, esophageal stenting is not without risks including stent migration, prosthesis obstruction, and fistula development.

Therefore, a multi-disciplinary approach to these patients is vital in deciding whether to pursue esophageal stenting.

6.5 Approach to Nutrition

Rates of malnutrition among the elderly with dysphagia is higher than those without dysphagia. One study evaluating dysphagia and malnutrition in nursing homes found that 52% of patients with dysphagia had co-existing malnutrition compared to 17% who did not have dysphagia [123]. Malnutrition in the elderly can have severe consequences. It can lead to decrease muscle mass and functional decline, increase the risk of falls and fractures, increase the rate of hospitalization and lengthen hospital stays, and increase mortality [124-127]. The most common reasons for percutaneous endoscopic gastrostomy (PEG) tube placement in elderly patients in America include stroke, neurodegenerative disorders, and cancer [128]. The general consensus among global guidelines is the practice of patient-tailored nutritional support in the setting of malnutrition, which can include artificial nutrition [129-132]. There are multiple artificial nutrition modalities to address malnutrition in the elderly, including naso-enteric tubes, percutaneous feeding tubes, and parenteral access. The type of access chosen should be patient specific and dependent on the underlying etiology of the dysphagia and individualized to patient’s goals. The use of artificial nutrition in the elderly with advanced dementia is debated. Global guidelines generally recommend against artificial nutrition in the elderly with advanced dementia [133, 134]. However, some guidelines suggest enteric and parenteral access may be appropriate in patients with dementia if there are appropriate medical indications for the patient [135-137]. While PEG tube placement is generally a safe procedure in the elderly, local and systemic complications can arise. Aspiration pneumonia can be a common cause of death in patients even after undergoing PEG tube placement [138]. Additionally, malnutrition in the elderly while hospitalized with aspiration pneumonia has been linked to development of sarcopenia. This in turn, leads to muscle atrophy including swallowing and respiratory muscles and worsening of both sarcopenia and risk of recurrent aspiration pneumonia. While sarcopenia and dysphagia have been strongly associated, there is little data on the utility of screening for sarcopenia as a means of identify patients at risk for dysphagia [31]. However, both can be assessed using geriatric screening tools such as the EAT-10 and SARC-F questionnaires [139]. Early nutritional support is key in preventing the further progression of sarcopenia and thus, refractory and recurrent pneumonia. This can be accomplished with non-pharmacologic and pharmacologic options as detailed above. Temporary supplemental nutrition such as parenteral or enteral nutrition can be considered. However, it is important to note that in one prospective study of bedridden elderly patients suffering from dysphagia, once pneumonia occurred, patients who were tube fed did not survive for more than half a year [140, 141]. Furthermore, many studies have shown no improvement in long-term survival rates in patients with advanced dementia and dysphagia who underwent PEG placement [142]. In addition, the data around the impact of PEG tube on functional status and quality of life in the elderly is mixed and often conflicting [143]. For this reason, it is imperative that providers engage in a multi-disciplinary discussion with the patient and family to consider the suitability of the patient and safety of Ethe procedure. Patient/caregiver education is this discussion is vital in understanding the long-term implications and expectations of tube feeding prior to proceeding with PEG tube placement. Other management approaches, such as alternative feeding strategies should be engaged beforehand as well. Of note, data around the difference in complications and mortality when comparing nasogastric tube (NGT) versus PEG in feeding of older individuals in non-stroke dysphagia are inconclusive [144].

7. Conclusion

Dysphagia in the elderly is a geriatric syndrome that is common and associated with mortality and morbidity. In evaluating dysphagia, it is important to determine underlying etiology through thorough history and physical exam, as well as with endoscopic, radiographic and manometric work up if indicated. Management should be multi-disciplinary and aimed not only at addressing the underlying issue but also addressing nutrition and quality of life.

Author Contributions

Dr Spandorfer, Dr Stuart, Dr. Waidyaratne and Dr. Daboul contributed to the research, analysis, and writing of the review article. Dr. Chakraborty served as the corresponding author and provided overall supervision and guidance throughout the project and reviewed and revised the final manuscript.

Competing Interests

The authors have declared that no competing interests exist.

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