

Dysphagia in the Elderly

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Opinion Statement

Dysphagia is a common problem in the elderly population with an especially high prevalence in hospitalized and institutionalized patients. If inadequately addressed, dysphagia leads to significant morbidity and contributes to decreased quality of life. Dysphagia can be categorized as emanating from either an oropharyngeal or esophageal process. A disproportionate number of elderly patients suffer from oropharyngeal dysphagia with a multifactorial etiology. Historically, treatment options have been limited and included mostly supportive care with a focus on dietary modification, food avoidance, and swallow rehabilitation. Nascent technologies such as the functional luminal imaging probe (FLIP) and advances in esophageal manometry are improving our understanding of the pathophysiology of oropharyngeal dysphagia. Recent developments in the treatment of specific causes of oropharyngeal dysphagia, including endoscopic balloon dilations for upper esophageal sphincter (UES) dysfunction, show promise and are expected to enhance with further research. Esophageal dysphagia is also common in the elderly and more commonly due to an identifiable cause. The full breadth of treatment options is frequently unavailable to elderly patients due to comorbidities and overall functional status. However, the increasing availability of less invasive solutions to specific esophageal pathologies has augmented the number of treatment options available to this population, where an individualized approach to patient care is paramount. This review focuses on the evaluation and management of dysphagia in the elderly and delineates how standard and novel therapeutics are contributing to more nuanced and personalized management.

Introduction

Dysphagia is a prevalent and increasingly common problem in the elderly population. Over 13% of the total population 65 years of age and older and 51% of institutionalized elderly individuals are affected by dysphagia [1]. Additionally, dysphagia affects 16% of independently living individuals

aged 70–79 and 33% of the older-than-80 age group with an even higher prevalence among older hospitalized patients [1]. In one study, even among the elderly who did not complain of dysphagia, up to 63% of patients had abnormal swallow function on radiologic swallow studies [2].

Swallow Mechanism

Conceptualizing the mechanism of a normal swallow is vital in order to properly evaluate the particular symptoms, diagnostic workup, and treatment options of dysphagia. The process of deglutition is fundamentally divided into three sequential phases which include the oral phase, the pharyngeal phase, and the esophageal phase.

The oral phase is further subdivided into the preparatory phase and the transport phase. The preparatory phase is unique in that it is entirely voluntary and consists of food entering the oral cavity and being actively masticated to form a homogenous bolus. This bolus is then collected on the anterior portion of the tongue and pushed toward the posterior portion of the oral cavity by a posterior and superior lingual movement during the transport phase [3].

The pharyngeal phase then subsequently begins with the rising of the soft palate and the contraction of the velopharyngeal muscles that help close the nasopharynx to prevent nasopharyngeal regurgitation. The next steps are composed of coordinated movement of the true vocal cords, the false vocal cords, the hyoid bone, and the epiglottis. When the epiglottis is in position to protect the larynx, it also functions to divert the homogenous bolus toward the piriform sinuses. At this point, the inferior pharyngeal muscles contract, resulting in pharyngeal peristalsis [4]. Lastly, the cricopharyngeus relaxes and the upper esophageal sphincter (UES) opens, allowing the bolus to pass into the esophagus.

The involuntary esophageal phase begins when the bolus enters the striated muscle-predominant upper esophagus. Utilizing central and ultimately peripheral neuromuscular influence, the bolus is moved by peristalsis to the distal smooth muscle portion of the esophagus and finally through the lower esophageal sphincter (LES). This phase usually takes approximately 8 s to complete [4].

The mechanism of swallowing is heavily dependent on neurological input. Regarding central nervous system input, in addition to medullary structures, MRI and transcranial magnetic stimulation have demonstrated that bilateral and widely distributed cortical and subcortical networks are involved [1]. These networks include the premotor cortex, the insula, the cingulate gyrus, the supplementary motor area, primary and secondary sensorimotor cortex, sensorimotor integration areas, and the basal ganglia [1]. As mentioned, the enteric nervous system also applies peripheral

neural input and has a primary role in peristalsis during the esophageal phase of swallowing.

Dysphagia as a Geriatric Syndrome

With the increasing prevalence of dysphagia in the elderly population, it is becoming increasingly recognized as a “geriatric syndrome.” This terminology was created in 1909, and its usage has become more common with other geriatric syndromes including immobility, instability, incontinence, intellectual impairment, sarcopenia, and frailty [5]. The definition of a geriatric syndrome has evolved over time, but these particular patient attributes can now be defined as “clinical conditions in older persons that do not fit into disease categories but are highly prevalent in old age, multifactorial, associated with multiple comorbidities and poor outcomes and are only treatable when a multidimensional approach is used.” [6].

Types of Dysphagia

Dysphagia can be categorized as oropharyngeal or esophageal. Oropharyngeal dysphagia is defined as a disturbance in the oral preparatory, oral transport, and/or pharyngeal swallowing phases [3]. There are multifactorial reasons why oropharyngeal dysphagia is a common presentation in the elderly population. Several physiologic changes that accompany the aging process include loss of muscle mass and function, decreased tissue elasticity, cervical spine changes, decreased saliva production, and reduced compensatory capacity of the brain. In one study, it was found that the mass of the geniohyoid muscle was reduced in elderly individuals as compared to the younger population with an even larger loss of mass in patients experiencing aspiration events [7]. These physiologic changes can lead to findings such as reduced tongue pressure, delayed initiation in the swallow reflex, prolonged oral phase, and decreased swallow volume, each of which can predispose to dysphagia [1]. Additionally, it has been found in a study by Ren et al. that deterioration of the pharyngo-upper esophageal sphincter contractile reflex in the elderly can also lead to difficulty in swallowing and dysphagia [8].

Esophageal dysphagia is characterized by difficulty in swallowing as a result of esophageal dysfunction during the esophageal phase. Common disorders leading to esophageal dysphagia in the elderly are reviewed in this paper.

Specific Populations Affected

The elderly population is prone to several neurological diseases that then predispose them to the development of dysphagia. In a meta-analysis conducted by Martino et al., 51–55% of stroke patients had clinical symptoms of dysphagia following a stroke and 64–78% of patients were found to have dysphagia on diagnostic testing after a stroke [5]. It has been found that dysphagia as a result of a stroke is due to loss of connectivity within the aforementioned swallowing network which results in decreased functionality of the swallow mechanism, typically disrupting not only the stroke-affected side

but also the stroke-unaffected side [1].

Dysphagia in Parkinson's disease (PD) is a common manifestation of this neurologic condition. The Unified Parkinson's Disease Rating Scale, a self-assessment questionnaire for patients with PD, found a 32% prevalence of dysphagia and that patients were able to self-assess aspects of abnormal swallowing function even if videofluoroscopy failed to show swallowing changes [9]. Additionally, a 2011 meta-analysis of patients with PD showed a 35% prevalence based on subjective criteria and up to 82% prevalence of the cohort based on objective data [5]. It is thought that the reduced motor function associated with decreased dopaminergic output leads to decreased swallow function as well. Interestingly, a study assessing respiratory-swallowing coordination found that "individuals with Parkinson's disease followed a greater percentage of swallows with an inspiratory event" which elucidates a key potential reason why these patients are prone to dysphagia, penetration, and frank aspiration [10].

Alzheimer disease and dementia are also risk factors for the development of dysphagia in the elderly. A meta-analysis by Affoo et al. demonstrated a prevalence of subjective dysphagia in 32–45% of patients with Alzheimer disease with objective evidence of dysphagia in 84–93% of instrumentally tested dysphagia in the same cohort [11].

Consequences of Dysphagia

It is of paramount importance to diagnose and treat dysphagia in the elderly due to the multiple medical consequences and subsequent increase in morbidity and mortality that can result from untreated disease. Aspiration pneumonia has a high mortality rate in the elderly population, emphasizing the critical importance of understanding its relationship to dysphagia [5]. One study demonstrated that the annual occurrence of lower respiratory tract infections was nearly doubled in patients with dysphagia as compared to patients with normal swallow function [5]. Furthermore, the prevalence of aspiration pneumonia increases with age with almost 90% of admissions for aspiration pneumonia occurring in patients 90 years old and older [5].

Malnutrition and dehydration can also result from unaddressed dysphagia in the elderly. In patients who are prone to decreased oral intake as a consequence of age-related anorexia, cognitive decline, and chewing problems, dysphagia further increases the possibility of dehydration and malnutrition [1]. A study of individuals living independently showed that the percentage of patients with oropharyngeal dysphagia who were suffering from malnutrition or were at high risk of developing malnutrition was as high as 21.7% [5]. The importance of this is clear as malnutrition can lead to further complications such as immunodeficiency, hypovolemia, sarcopenia, morbidity, and death.

Diagnosis of Dysphagia

The first step in evaluating a patient with dysphagia is to differentiate the dysphagia as oropharyngeal or esophageal in nature. One of our authors has previously published a useful algorithm suggesting the steps in this overall evaluation [4]. Figure 1 delineates a modern overall approach, and we have

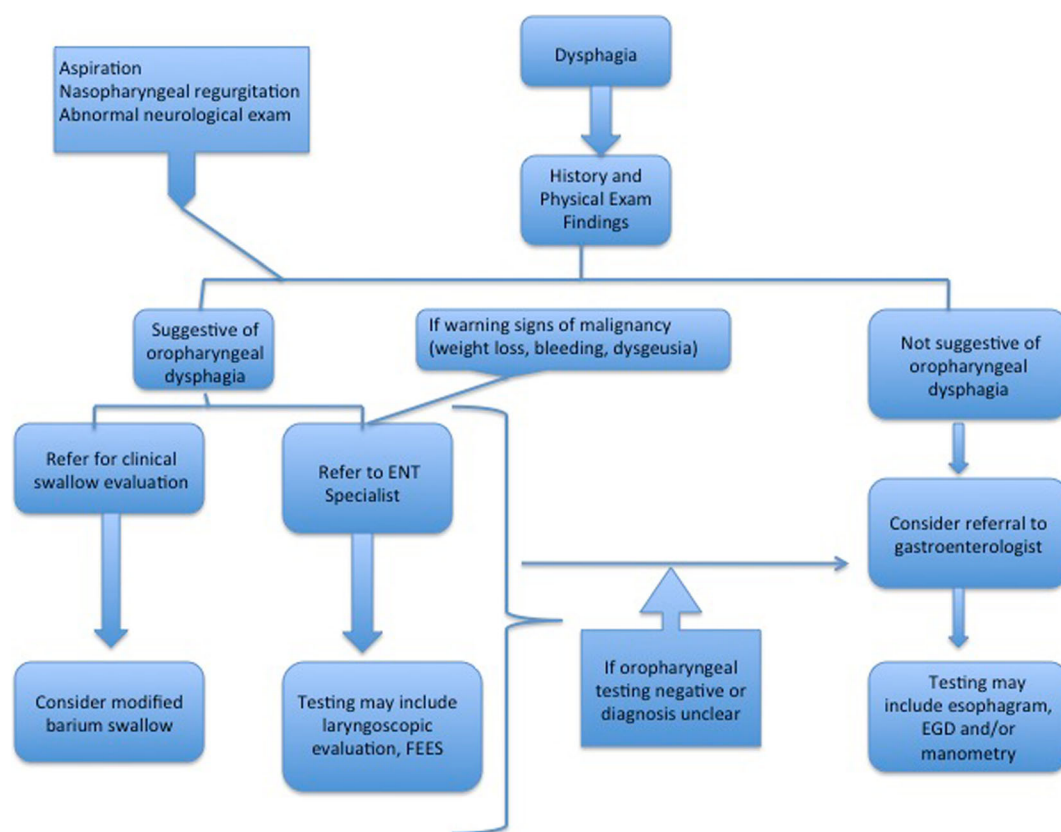


Fig. 1. Algorithm for workup of dysphagia in the elderly. Original figure adapted from Khan et al. [4].

updated the algorithm accordingly.

Before discussing the evaluation of a particular patient with dysphagia, it is important to recognize the role of screening. The main goal of screening is to identify patients who are at risk of developing dysphagia and those who may warrant more involved evaluation. According to two systemic reviews which evaluated the efficacy of available screening modalities, only a small number of screening modalities were found to have a sensitivity greater than 70%, a specificity greater than 60%, and a high reliability [3]. These include the Toronto Bedside Swallowing Screening Test, the Volume-Viscosity Swallow Test, the Standard Swallowing Assessment, and the Gugging Swallowing Screen [3]. Efficacious screening methods are vital because they have been found to help lower complications of dysphagia such as pneumonia, feeding tube dependency, and death.

Complications can also be prevented when higher-risk populations are screened earlier and more often. In order to do this properly, it is important to know which populations are at higher risk. For example, elderly individuals from Korea were found to have a lifetime prevalence of dysphagia of approximately 17.1% [12]. This study calculated that this translated to roughly one fifth of the elderly Korean population developing dysphagia. Other elderly populations at high risk of developing dysphagia are patients who use dentures,

who have poor physical functioning, and who require assistance in activities of daily living. Patients who required assistance, for example, were found to have a 4.3-fold increased risk of developing dysphagia [12]. If these populations are actively sought and screened early, many health complications could be avoided.

When an elderly patient is identified with dysphagia, an attentive history and physical examination are needed to determine if the symptoms are suggestive of either an oropharyngeal or esophageal process. As in Fig. 1, aspiration, nasopharyngeal regurgitation, and an abnormal finding from a neurological exam are more suggestive of oropharyngeal dysphagia.

A proper medical and swallow history is vital in determining if a patient needs a further evaluation. This includes ascertaining the regularity, progression, and timing of the dysphagia. Questionnaires such as the EAT-10 as well as the Sydney Swallow Questionnaire can be used [3]. The physical exam in the evaluation of dysphagia should include an evaluation of the patient's respiratory, nutritional, mental, and neurological status. Early signs of neurological disease associated with swallowing are a weak voice, cough, or impaired facial movement.

When a clinical evaluation suggests oropharyngeal dysphagia in an elderly patient, the official evaluation and subsequent management rely upon a multidisciplinary approach that can involve gastroenterology, speech pathology, neurology, radiology, and ear, nose, and throat (ENT) physicians [3]. If there are no warning signs suggestive of a need for direct ENT laryngoscopic evaluation such as weight loss, bleeding, or dysgeusia, a referral to a clinical swallow specialist is recommended.

A proper comprehensive oral exam conducted by this specialist, usually a speech-language pathologist, will assess cranial nerves and their associated structures as well as articulation, resonance, and phonation [3].

Imaging for the Diagnosis of Oropharyngeal Dysphagia

After clinical swallow assessment, there are several diagnostic tools that can be utilized in the assessment of oropharyngeal dysphagia. A videofluoroscopic (VF) swallow study is real-time imaging done utilizing a barium bolus swallowed by an upright sitting patient which allows evaluation of the anatomy and function of the oral cavity, pharynx, and UES [3]. The goal of this imaging modality is to identify a specific disorder and, if it is present, utilize this information in order to give the patient therapeutic interventions in order to avoid the consequences of the dysphagia such as aspiration [3]. VF is considered the gold standard for evaluation of aspiration. It also allows for the numerical measurement of the timing of the opening and closing of the glossopharyngeal junction, velopharyngeal junction, UES, and laryngeal vestibule [3].

If the specific etiology of oropharyngeal dysphagia remains unclear after VF, direct ENT visualization can be helpful. If no direct pathology is found to explain the dysphagia, flexible endoscopic evaluation of swallowing (FEES) is a method utilizing a flexible laryngoscope to directly visualize the pharynx and larynx during each stage of swallowing. This can be performed at the bedside transnasally and allows the clinician to assess for secretions and the presence of aspiration and penetration, and allows for the evaluation of the timing of the

swallow onset [3, 13]. Despite its practicality as a diagnostic tool, there are some limitations associated with FEES such as the dependence on a subjective interpretation of the test which can be improved by using more objective penetration-aspiration [3].

Other technologies also may be helpful in uncovering the disorder leading to oropharyngeal dysphagia in an elderly patient. High-resolution esophageal manometry, typically performed by a gastroenterologist, can be used to evaluate the muscular function of the pharynx and UES while swallowing [14]. It can be used to help evaluate swallow physiology, swallow maneuvers, head posture, and bolus consistency and volume [14]. Three-dimensional esophageal manometry is a novel technology that can also be utilized to improve understanding of UES pressure which may open the door to new potential treatments for UES dysfunction [15•]. Although useful in certain clinical circumstances, important limitations to high-resolution manometry include discrepancies between findings, aspiration risk, and difficult analysis and interpretation of findings [3]. However, when used in conjunction with videofluoroscopy, it can provide a more detailed evaluation of bolus transport, and this technology continues to advance [16].

The functional lumen imaging probe (FLIP) is a novel technology using impedance planimetry that can evaluate the distensibility of an area in the gastrointestinal tract by measuring the cross-sectional area and pressure simultaneously [17, 18]. This is typically performed by a gastroenterologist on upper endoscopy and has been shown to have a variety of uses throughout the luminal gastrointestinal tract which can include the UES as well [19, 20]. With this technology and the continued improvements in high-resolution manometry in the evaluation of the UES, gastroenterological assessment of oropharyngeal dysphagia continues to expand.

Diagnosis of Esophageal Dysphagia

If the dysphagia in an elderly patient is not suggestive of an oropharyngeal process, an evaluation of esophageal dysphagia is needed. An esophagram, esophagogastroduodenoscopy (EGD) or upper endoscopy, and manometry can all be helpful. An esophagram consists of a patient swallowing barium under radiologic visualization as it travels down the esophagus. It can be utilized as the initial test for diagnosing and evaluating esophageal dysphagia in the elderly and gives an overall assessment of the anatomy and function of the esophagus. Tumors, strictures, webs, and ulcers can all be visualized during this examination. Furthermore, while not the gold standard test for esophageal motility and peristalsis, an esophagram can guide the decision of whether an esophageal manometry is needed.

Esophageal manometry is a transnasal test that can be used to help diagnose esophageal motility disorders by measuring the peristaltic motion of the esophagus as well as the functionality of the LES. Further insight and classification of esophageal motility disorders have been made in recent years with the advent of high-resolution manometry which can help differentiate the causes of esophageal dysphagia in a particular patient [21]. FLIP technology has also been increasingly shown to provide beneficial assessment of the lower esophageal sphincter and can supplement manometry in some cases [17].

An EGD can directly visualize the esophagus but is typically performed transorally with anesthesia support and thus carries additional procedural risks in elderly patients who may have significant comorbidities. Thus, an EGD purely for the diagnosis of dysphagia is usually performed only if the diagnosis is still in doubt after utilization of the less invasive modalities just described. Beyond its diagnostic capabilities, there is certainly a role of EGD for the treatment of dysphagia which will be covered in the ensuing sections.

Treatment of Oropharyngeal Dysphagia

As the US population ages, new methods of treating the underlying cause of the symptomatology in these patients are increasingly needed. A summary of standard and novel techniques based on the mechanism and subcategory of oropharyngeal dysphagia is reviewed here.

The treatment of pure oral dysphagia is aimed at the preparation and transport of the food bolus toward the pharynx. In the elderly, important interventions include ensuring properly fitting dentures and swallow therapy exercises aimed at strengthening the muscles of mastication. Adequate salivary production can be achieved by use of stimulatory agents such as gum or mints. Pharmacologically, muscarinic agonists such as pilocarpine or cholinergic agonists like cevimeline can be utilized. If excess endogenous production cannot be achieved, use of saliva substitutes can be employed [22].

The treatment of pharyngeal dysphagia is instead targeted to the direct, specific causes. Cervical osteophytes, which contribute to dysphagia by causing esophageal inflammation or muscle spasm, can be treated conservatively with nonsteroidal anti-inflammatory drugs, diet modification, swallow therapy, steroids, or muscle relaxants which are particularly effective if the dysphagia is caused by spasm. Surgical osteophytectomy can be an effective treatment for dysphagia caused by mechanical compression secondary to cervical osteophytes, usually found in patients with underlying skeletal disease such as diffuse idiopathic skeletal hyperostosis (DISH) or ankylosing spondylosis, provided other etiologies of dysphagia have been ruled out. However, recurrence of symptoms has been noted and the risks and benefits of surgery have to be carefully weighed [23].

Dysfunctions of the UES such as cricopharyngeal bar or spasm traditionally have been diagnosed with videofluoroscopy, but as mentioned, high-resolution manometry may have a role as well. Active and passive balloon swallow therapy has been shown to improve dysphagia in patients with cricopharyngeal dysphagia; however, the long-term utility of dilating the UES in these instances is unknown and prospective studies are needed to determine the best approach [24, 25]. Endoscopic balloon dilation has shown improvement in symptoms at the 21-month follow-up post-procedure in one study [26]. Injection of botulinum toxin can also be effective at temporarily decreasing cricopharyngeal spasm. Improvement in symptoms lasts 5 months on average but can be as short as 2 months,

and patients may require multiple injections [27]. Overall success rates range from 20 to 100% with minimal complications [28]. Cricopharyngeal myotomy can be effective for long-term relief of dysphagia for up to 71% of patients if symptoms can be specifically isolated to cricopharyngeal spasm [28]. However, it should be noted that all manipulation of the UES should be performed by physicians cognizant of the increased likelihood of regurgitation of esophageal contents, either from GERD or dysmotility, and of the increased risk of pharyngeal aspiration of esophageal contents that occurs with opening of the UES. Thus, manipulation of the UES in elderly patients with dysphagia should be done by experienced practitioners who also understand the risks of the procedure and who can assess proximal gastroesophageal and esophagopharyngeal reflux.

If the dysphagia is due to the presence of Zenker's diverticulum, often due to chronic UES dysfunction, the first line of treatment is to consider endoscopic dilation of the UES. This can be performed by either experienced ENT physicians or gastroenterologists. Cricopharyngeal myotomy and diverticulectomy can be effective treatments for more severe disease [24]. In one study, up to 94% of patients remained symptom free for 48 months after diverticulectomy, and the majority were symptom free for up to 10 years [28].

Dysphagia caused by underlying neurologic conditions such as stroke, Parkinson's disease, or dementia is common in the elderly population and can be challenging to treat. Diet modifications, postural changes, and swallow therapy can decrease the risk of aspiration in this patient population [1]. An RCT studying elimination of aspiration as assessed by VF found that a honey-thickened liquid diet was the most effective; however, this should be individualized to the patient based on the specific swallow study [29]. Additional maneuvers such as chin tilt, Shaker head raising, and isometric lingual exercises can also lead to improved swallow function and improved quality of life [30]. In stroke patients, novel techniques such as repetitive transcranial magnetic stimulation can be employed to try to improve dysphagia [31•]. More recently, video-guided balloon dilation of the cricopharyngeal muscles by repetitive inflation of a balloon catheter has been shown to improve swallowing function in one out of three patients in a small series with no evidence of aspiration at 6 months [32•]. In Parkinson's disease, specific swallow training can improve neuromuscular control of the upper digestive tract leading to 51% reduction in observed swallow motility disorders [32•]. Unfortunately, current standard treatments of the underlying disease such as L-dopa therapy [30, 33] or deep brain stimulation [34] have failed to lead to clinically significant improvements in swallowing function.

Head, neck, and esophageal tumors can lead to persistent oropharyngeal or esophageal dysphagia which significantly impacts quality of life in up to 45% of patients for more than a year after surgery [35]. Patients with advanced malignancy leading to dysphagia and malnutrition are one of the only patient populations in which percutaneous endoscopic gastrostomy (PEG) is indicated. In one study, placement of a prophylactic

PEG tube was associated with an improved quality of life and decreased malnutrition [36]. Further studies have found that use of prophylactic PEG in this subset of patients does not lead to long-term dysphagia in up to 8 years of follow-up [37].

Treatment of Esophageal Dysphagia

Treatment of pure esophageal dysphagia in the elderly population should be tailored to the underlying disorder. Importantly, risks of each individual treatment option need to be carefully weighed against the expected benefits from each management choice in this population. Table 1 briefly summarizes the most common causes of esophageal dysphagia in the elderly and the corresponding treatment options.

Gastroesophageal reflux disease (GERD) is a leading cause of dysphagia in the elderly. Increased inflammation due to reflux of gastric contents itself can lead to dysphagia as can long-term complications of untreated GERD such as strictures [28]. Proton pump inhibitors (PPIs) remain the mainstay of treatment of GERD in the elderly despite recent concerns about their long-term use and the potential risks including bone fractures, dementia, and kidney disease [38]. A recent review by the American Gastroenterological Association summarized that the studies used to accumulate the data on PPI risks were generally retrospective observational studies with low- to very-low-quality evidence [39]. Thus, if an elderly patient has a clear indication for chronic PPI, it can be used as long as no side effect from the PPI has been delineated in that individual.

Table 1. Common etiologies of dysphagia and treatment options

Etiology	Treatment option
Oral dysphagia	Promote salivation, ensure properly fitting dentures, strengthen muscles of mastication
Cervical osteophytes	NSAIDs, diet modification, swallow therapy, muscle relaxants, rarely surgery
Cricopharyngeal bar	Endoscopic botulinum toxin injection and/or dilation, endoscopic or surgical myotomy
Zenker's diverticulum	Endoscopic dilation of UES, cricopharyngeal myotomy, diverticulotomy
Neurologic conditions ^a	Swallow therapy, dietary modification, consider endoscopic dilation of UES
Gastroesophageal reflux disease	Diet and lifestyle changes, acid suppressive medications, rarely endoscopic or surgical procedures
Eosinophilic esophagitis	PPIs, swallowed steroids, dietary modifications
Webs, rings, strictures	Endoscopic dilation, endoscopic injection of steroids, endoscopic stenting
Achalasia	Endoscopic dilation and/or botulinum toxin injection; if surgical candidate, consider pneumatic dilation, Heller myotomy, or POEM
Spastic esophageal disorders	Calcium channel blockers, nitrates, anticholinergics, phosphodiesterase inhibitors, rarely POEM

NSAIDs nonsteroidal anti-inflammatory drugs, *UES* upper esophageal sphincter, *PPIs* proton pump inhibitors, *POEM* peroral endoscopic myotomy

^aIncluding stroke, Parkinson's disease, and dementia, among others

For patients with GERD who do not respond to PPI treatment, there are several endoscopic anti-reflux therapy options; however, these have not been studied specifically in the elderly population. Patients treated with radiofrequency therapy in one study had at least 50% improvement in symptoms, and the majority were PPI free at the 5-year follow-up, but there is no clear data suggesting that this device truly normalizes esophageal acid exposure [40]. Transoral incisionless fundoplication has been shown to improve quality of life and decrease use of PPIs in 84% of patients followed at 36 months [41]. MUSE endoscopic fundoplication (with use of a stapler) eliminated PPI use in 65% of patients [42]. Anti-reflux mucosectomy has shown improved symptoms and discontinuation of PPIs at short-term follow-up. These less invasive measures show promising results but are currently not as efficacious as the gold standard treatment, laparoscopic Nissen fundoplication. This surgery is recommended as an option for patients with chronic GERD with typical symptoms [43], but it has not been well studied in elderly patients who also may have comorbidities precluding them from laparoscopic surgery. Lastly, magnetic sphincter augmentation has shown some promise in controlling chronic GERD with similar rates of symptom resolution at 1 year as Nissen fundoplication [44] and is subject to the same limitations as Nissen fundoplication in the elderly population [45].

Eosinophilic esophagitis (EoE) is an immune-mediated inflammatory condition of the esophagus that can cause dysphagia. EoE is an increasingly recognized disease with several different treatment options, and there may be some benefit to PPI therapy. Patients with EoE who fail to respond to PPI therapy can be treated with topical corticosteroids or proceed with dietary modifications that eliminate allergenic foods. Both of these treatments have shown improvement in symptoms and signs of inflammation [46]. As EoE is both a relatively new disease and affects predominantly a younger population, the ideal treatment strategy for elderly patients remains to be determined.

There are several anatomic or obstructive causes of esophageal dysphagia. Benign esophageal strictures, when symptomatic and contributing to dysphagia, can generally be treated with endoscopic dilations [47]. Injection of intra-lesion steroids can increase the length of symptom remission and increase the time to repeat dilation [48]. For recurrent strictures, self-expanding metal or plastic stents can be used to relieve symptoms. Although rare, complications of endoscopic dilations and stent placement can be serious and include perforation as well as stent migration [48]. Plummer-Vinson syndrome, a specific disease defined by dysphagia, iron-deficiency anemia, and esophageal webs, should first be treated with iron supplementation as that alone is sufficient to relieve dysphagia in most patients [49, 50].

In rare cases, dysphagia can be caused by external compression of the esophagus. It may be due to aberrant anatomy such as in dysphagia lusoria in which the right subclavian artery originates distal to the left and crosses the midline, or abnormal size or shape of vessels such as dysphagia aortica due to compression by the aorta and cardiac dysphagia caused by left atrial enlargement [51]. Treatment is generally conservative and first aimed at

treating the underlying cardiac or vascular disease. If symptoms of dysphagia persist, next-line therapies include the addition of a PPI or a pro-motility agent [52]. Surgery is only rarely considered for the most severe cases [53].

Esophageal neuromuscular and motility disorders can also afflict elderly patients with dysphagia. Achalasia is the most well-described primary motility disorder which has recently been subdivided into three different patterns of disease that have different rates of response to standard treatment options [54]. In the elderly patient, it is important to know if the patient is a surgical candidate as most treatment algorithms are based on this surgical risk [55]. If the patient is a surgical candidate, there are several treatment options. Endoscopic pneumatic balloon dilation uses a balloon inflated at the level of the gastroesophageal junction to attempt to cause a sustained decrease in pressure of the LES. Laparoscopic Heller myotomy (LHM) with partial fundoplication can improve dysphagia in the vast majority of patients. This surgical option may be suitable even for elderly patients as one study found no significant difference in mortality, complications, or treatment failure in patients aged 70 or older compared to younger cohorts [56]. When compared to LHM in a randomized controlled trial, endoscopic pneumatic balloon dilation has similar rates of success compared to LHM at up to 5 years of follow-up [57, 58]. Type II achalasia responds the best to both pneumatic dilation and LHM, while type III comparatively responds poorly to both but better to LHM [59, 60]. A more novel technique, peroral esophageal myotomy (POEM), has similar results to the more invasive LHM which has a potential advantage for type III achalasia; however, long-term data is needed and there is some concern about the increase in GERD post-POEM [61]. In patients who are inappropriate candidates for both surgery and more invasive procedures, botulinum toxin injection with or without less aggressive endoscopic balloon dilation can provide relief of symptoms. Unfortunately, the efficacy of repeat injections of botulinum toxin decreases over time on average, and inflammation and fibrosis at the sites of injections can make definitive myotomy more complicated. Lastly, medications attempting to relax the smooth muscle of the LES are an option, but usually do not have a sustained benefit [55].

Esophagogastric junction outflow obstruction, jackhammer esophagus, and distal esophageal spasm are other esophageal motility disorders that can cause dysphagia [21]. Medications that may be effective at improving symptoms include nitrates, calcium channel blockers, anticholinergics, phosphodiesterase inhibitors, and tricyclic antidepressants [62]. In severe cases, POEM may be offered; however, this should be done with significant caution as there is no long-term data on risks and benefits [63, 64].

Absent contractility, aperistalsis, and a hypotensive LES can lead to dysphagia and GERD. Conservative treatment is aimed at controlling reflux symptoms with diet and lifestyle modifications and medical management with PPIs [65]. Procedural management of the LES is reserved for specific cases and at specialized centers.

In summary, there are several standard and novel treatment options for the various disorders that lead to both oropharyngeal and esophageal dysphagia. In

the elderly population, individual attention to the risks of each management option is vital in deciding upon the overall treatment plan. More studies are needed in the elderly population to address the balance between the benefits of each treatment option on quality of life in the elderly population in comparison to the risks of the intervention.

Compliance with Ethical Standards

Conflict of Interest

Scott M. Smukalla, Irina Dimitrova, and Jeremy M. Feintuch declare that they have no conflict of interest. Abraham Khan is on the speaker bureau for EndoGastric Solutions in 2017. This company does work with GERD, which is a topic covered in minor detail in this paper.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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