Dysphagia as a Cause of Chest Pain: An Otolaryngologist’s View

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Dysphagia is an important alarm symptom, as is chest pain. The combination of the two can pose difficulties in terms of diagnosis due to the causal relationship between the two conditions (Fig. 1). The main diagnosis to rule out in a patient presenting with retrosternal chest pain is a myocardial infarction, a medical emergency usually treated in the emergency department, for which no time may be wasted or lost. Patients presenting with dysphagia, that is, difficulty and pain when swallowing, must undergo a thorough clinical and diagnostic evaluation. When presenting to an otolaryngologist, the physical examination includes direct and indirect laryngoscopy in the awake and cooperative patient. Further, a rigid hypopharyngoscopy and esophagoscopy must be performed under general anesthesia, if all other possible causes for dysphagia, such as neurologic or cardiac causes, are ruled out. Dysphagia is an alarm signal, because (eg, in the case of a foreign body aspiration) it can result in the perforation of the hypopharynx, with consequent mediastinitis or pneumonia and lethal sepsis.

EPIDEMIOLOGY

Prevalence

There is a lack of studies documenting the epidemiology of dysphagia. There are of course numerous patient-based reports of dysphagia being associated with...
cerebrovascular accidents, Parkinson disease, and esophageal malignancy, to mention a few.\textsuperscript{2,3} Population-based studies are rare, with only a few currently published.\textsuperscript{4–8} Moreover, the estimated prevalence of dysphagia in these studies was between 6\% and 22\%, which is somewhat high.

A Swedish study of 2329 individuals older than 55 years found that almost one-third (27\%) had esophageal dysfunction and 13\% with normal esophageal function had dysphagia. No mention was made of differences in prevalence by gender, but the overall prevalence was reported as 22.3\%.\textsuperscript{4} Bloem and colleagues\textsuperscript{5} conducted a study of 130 elderly individuals (aged >87 years) from the Netherlands and observed that 16\% had symptoms of dysphagia, but that these symptoms were not associated with age, gender, or mental status. A larger study (n = 556) of 50- to 79-year-old individuals in the community reported that a very small number (1.6\%) had obstructive symptoms and just over one-fifth (20.9\%) had globus sensation that increased slightly with increasing age.\textsuperscript{6} In a United States study of 1021 individuals aged 30 to 64 years, functional gastrointestinal symptoms were determined and 6\% of individuals reported trouble swallowing more than a quarter of the time.\textsuperscript{7} A Japanese study of elderly people (aged >65 years; n = 1313) living at home reported that 13.8\% had symptoms of dysphagia.\textsuperscript{8}

In a more recent population-based study that focused on dysphagia, it was determined that among an adult population 18 years and older the prevalence of dysphagia was 17\%, showing a positively skewed distribution (Fig. 2) with high rates among younger age groups, with a peak in the 40- to 49-year age group for both males (28\%) and females (34\%).\textsuperscript{9} This study was the first to assess dysphagia among younger adults in a community sample. All previous studies had assessed dysphagia among older adults, usually older than 50 years, due to the belief that it was more common in this age range; however, this finding highlighted that dysphagia is prevalent among younger individuals in the community.

\textbf{Risk Factors}

Risk factors associated with dysphagia have been largely unexplored. There have only been 7 studies looking at risk factors related to dysphagia, with all of these published after 2003. The main focus of these studies was spinal surgery (n = 3),\textsuperscript{10–12} stroke (n = 1),\textsuperscript{13} pediatrics (n = 1),\textsuperscript{14} geriatrics (n = 1),\textsuperscript{15} chemoradiotherapy (n = 1),\textsuperscript{16} and dysphagia (n = 1).\textsuperscript{9} Risk factors identified from these studies included larger radiation

\begin{center}
\textbf{Fig. 1.} The causal relationship between chest pain and dysphagia.
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A recent population-based study reported that hypertension was a risk factor for dysphagia (odds ratio [OR] = 2.58, 95% confidence interval [CI]: 1.22–5.44), while it is known that dysphagia has been reported as a complication of stroke. However, hypertension per se has not been previously reported, and it must be noted that some potential confounders (ie, body mass index, diet, alcohol intake, nonsteroidal anti-inflammatory drug use) could not be adjusted for in this study. In addition, this study reported several other independent risk factors including odynophagia with gastroesophageal reflux (OR = 3.41, 95% CI: 1.16–10.04), intermittent dysphagia with gastroesophageal reflux (OR = 2.96, 95% CI: 1.76–4.98), anxiety (OR = 1.09, 95% CI: 1.01–1.19), and a reduction in the “role physical” subscale (OR = 0.98, 95% CI: 0.97–0.99), while progressive dysphagia was associated with depression (OR = 1.34, 95% CI: 1.07–1.67) and reduced “general health” (OR = 0.95, 95% CI: 0.90–0.99).

Dysphagia as a Cause of Chest Pain

Dysphagia has been reported as a risk factor for noncardiac chest pain in the community. This study consisted of 1000 adult (>18 years old) individuals randomly selected from the Sydney population. The analysis revealed that dysphagia was associated with an almost 2.5-fold increased risk of chest pain (OR = 2.43, 95% CI: 1.54–3.84). Moreover, individuals experiencing an increased frequency of dysphagia (OR = 2.52, 95% CI: 1.63–3.89) and increased severity of dysphagia (OR = 1.95, 95% CI: 1.03–3.67) were more likely to have chest pain. It must be borne in mind that whereas chest pain is a common symptom that is very heterogeneous, (Guy D. Eslick, unpublished data, 2009) suggest that dysphagia is more common among patients with noncardiac chest pain (OR = 2.16, 95% CI: 1.02–4.73) than those with cardiac chest pain (OR = 0.73, 95% CI: 0.33–1.63) and even angiographically proven coronary heart disease (OR = 0.43, 95% CI: 0.23–0.94).
ANATOMY OF THE UPPER DIGESTIVE TRACT AND UPPER AIRWAYS

The upper digestive tract starts with lips, teeth, hard and soft palate including uvula, mandible, and maxilla. The floor of mouth and tongue are constructed of multiple muscles and connective tissue, as well as the palatine tonsils, and are covered by non-keratinizing, squamous cell epithelium. The pharynx consists of 3 pharyngeal constrictor muscles forming the superior pharyngeal constrictor, which causes elevation and contraction of the velum. This process achieves complete closure of the velopharyngeal port, and is facilitated by the contraction of the superior pharyngeal constrictor, which narrows the pharynx.

The medial and inferior pharyngeal constrictors initiate the pharyngeal peristalsis. The food bolus and saliva are carried by sequential peristaltic action of the middle and inferior pharyngeal constrictors into and through the pharynx to the cricopharyngeal sphincter.

The esophagus consists of 3 major narrowings, the first one being the cricopharyngeal sphincter, the second at the height of the aortic arch (with proximity of the right ventricle), and the third at the sphincter and entrance to the stomach.

The larynx is made up of thyroid cartilage, where fibers of the inferior constrictor attach to the sides of the thyroid cartilage anteriorly. Lateral of the thyroid cartilage are the piriform sinuses, which end inferiorly at the cricopharyngeus muscle, the most inferior structure of the pharynx, which serves as the valve at the top of the esophagus. The pharyngeal constrictors insert into the thyroid cartilage anteriorly to form the piriform sinuses. The uppermost structure of the larynx is the epiglottis, which rests against the base of the tongue. A wedge-shaped space called the vallecula is formed between the base of the tongue and epiglottis bilaterally. The valleculae and the piriform sinuses are known as the pharyngeal recesses or side pockets, into which food may fall and reside before or after the swallowing reflex is triggered. This area comprises the space where tumors can originate from or foreign bodies may get stuck.

On contraction, the pharyngoesophageal sphincter or juncture (P-E segment) prevents air from entering the esophagus during respiration and material from refluxing back up the esophagus and into the pharynx. The esophagus is a 23- to 25-cm long, hollow muscular tube.

PHYSIOLOGY OF THE SWALLOWING PROCESS

The swallowing process transports saliva or ingested material from the mouth to the stomach. The preparatory phase consists of taking material into the mouth; the food is chewed, mixed with saliva, and usually positioned on top of the anterior tongue in anticipation of a swallow. At the onset of a normal swallowing act, the tip of the tongue is pushed against the superior incisors or maxillary alveolar ridge. A semisolid or liquid bolus is cupped within a depression of the anterior one- to two-thirds of the tongue. During the oral phase of swallowing, the tongue elevates and rolls posteriorly in a peristaltic motion, making sequential contact with the hard and soft palate, thereby propelling the bolus into the pharynx. Entry of the bolus into the pharynx occurs simultaneously with elevation of the soft palate against the posterior pharyngeal wall, sealing the nasopharynx from regurgitation. The pharyngeal phase of swallowing starts as the moving wave of glossopalatal opposition crosses the fauces. Pharyngeal peristalsis continues as the posterior third of the tongue makes sequential descending contact with the posterior wall of the pharynx. Along with this, the pharyngeal constrictors contract in a descending sequence. In the hypopharynx, peristaltic obliteration of the pharyngeal lumen is achieved by opposition of the closed larynx and
the inferior pharyngeal constrictor. During the swallow sequence, the upper esophageal sphincter (UES), also termed the pharyngoesophageal sphincter, relaxes for about 0.5 seconds during which transsphincteric flow of a swallowed bolus occurs. The transiently relaxed UES, formed mainly by the cricopharyngeus, is opened by anterior traction exerted by the superior-anterior excursion of the hyoid and also by pulsion forces imparted by a swallowed bolus. During the oral and pharyngeal phases of swallowing, the larynx is lifted substantially upward and forward by the combined contraction of the suprahoid muscles, thyrohyoids, and pharyngeal elevators. This superior-anterior excursion of the larynx not only serves to open the UES by traction but also enlarges the pharynx to receive the bolus, engulfs the bolus, and acts as an ancillary mechanism to protect the larynx against aspiration. The major mechanism preventing aspiration of swallowed material into the larynx is contraction of the intrinsic laryngeal muscles, which approximate the arytenoids and epiglottis, close the false cords, and adduct the vocal cords. Passage of the pharyngeal peristaltic contraction wave through the cricopharyngeus terminates UES relaxation and marks the transition between the pharyngeal and esophageal phases of swallowing.

**NOMENCLATURE**

Dysphagia is defined by difficulty in swallowing, which can commonly occur, for example, due to a cold or following a stroke, or be caused by reflux disease or a tumor. Dysphagia compromises nutrition and hydration, and may lead to aspiration pneumonia and dehydration.

Aphagia is the inability to swallow. Patients present with drooling, as even their own saliva cannot be swallowed.

**DIAGNOSTIC WORKUP**

- A patient presenting to the Ear/Nose/Throat (ENT) Department or ENT specialist undergoes a thorough history taking. When did the symptom first occur, for how long does it persist, is the peroral food intake compromised? What is the location or lateralization of the dysphagia? Is it sudden onset or slow progression? Is there regurgitation of digested or undigested food or acid?
- The patient then undergoes a clinical physical examination including indirect laryngoscopy and loupe laryngoscopy. If no saliva remnants or foreign bodies are seen, radiologic examinations are initiated. Methylene blue and food swallow videography via transnasal flexible endoscopy are then performed.
- The radiologic examinations include static imaging of neck and chest (computed tomography [CT]/magnetic resonance), as well as dynamic investigation: A barium swallow (Fig. 3) examination and a videocinematograph show the peristalsis of the hypopharynx and esophagus, and may give hints to hypertrophic sphincter foreign bodies and tumors.
- Rigid esophagoscopy and hypopharyngoscopy (panendoscopy) are performed under general anesthesia in cases of suspected foreign body or tumor to facilitate extraction/biopsy.

**DIFFERENTIAL DIAGNOSES AND TREATMENT SUGGESTIONS**

As inflammatory causes of dysphagia, gastroesophageal reflux disease (GERD) must be primarily mentioned. The reader is referred to the article on GERD elsewhere in this issue.
An underlying infectious cause of esophagitis with chest pain and dysphagia may be Candida esophagitis in the immunosuppressed, but cases of other viral or bacterial infection of the digestive tract are known also in the immunocompetent host.\textsuperscript{25} Cardiac causes such as myocardial infarction or right heart hypertrophy can furthermore be the underlying cause of chest pain; however, one assumes that the patient has had a full cardiologic workup (including electrocardiograph, chest radiograph, and echocardiograph) before presenting to the otorhinolaryngologist. A mediastinal mass, such as a thymus tumor (most often a thymoma, lymphoma, or thymus tumor) is ruled out by a chest radiograph. The authors recently reported a patient with a cervical neurofibroma who had presented with progressive chest pain and globus sensation.\textsuperscript{26} A recent case report of a rare perforation of the esophagus due to an osteophyte\textsuperscript{27} must also be taken into consideration, and is easily diagnosed with a barium swallow and radiograph, as well as rigid panendoscopy. A Zenker diverticulum is diagnosed by a barium swallow radiograph, and usually presents with dysphagia and chest pain, as well as regurgitation of undigested food. Zenker diverticulum is best treated with a myotomy of the cricopharyngeal muscle, which may be performed transorally by laser (Fig. 4),\textsuperscript{28} or by endoscopic staple diverticulectomy.\textsuperscript{29,30} In specific cases, an open approach via lateral collotomy is performed.

\textbf{Cancer of the Hypopharynx}

Unl|ike many other cancers of the head and neck area, carcinoma of the hypopharynx is rarely found early when it is small and localized to the site of the primary lesion. More frequently, the patient is not aware of the problem until the tumor is large, obstructive symptoms or pain occurs, and the cancer extends to the adjacent structures and the cervical lymph nodes. The extensive lymphatic drainage of the hypopharynx
and the cervical esophagus and the long interval during which the tumor is asymptomatic account for the extensive involvement of lymph nodes and adjacent structures at the time of diagnosis. Therefore, hypopharynx tumors often present with dysphagia and aspiration due to infiltration of the arytenoid cartilage and the pharyngoesophageal sphincter. Hypopharyngeal carcinomas metastasize early into the cervical lymph nodes (Fig. 5). Specific diagnostic procedures for a staging examination include CT scans of the neck and rigid endoscopy under general anesthesia to facilitate biopsy of the suspected cancer tissues. Staging examinations should include a CT scan of the chest to exclude pulmonary metastases that are seen in about 10% of all cases. Surgery, usually in combination with postoperative radiotherapy/chemotherapy, is

Fig. 4. Intraoperative view of a laser resection of the cricopharyngeal muscle in a Zenker diverticulum. The string gauze protects the esophageal mucosa from injury by a laser beam.

Fig. 5. CT scan of a hypopharyngeal cancer on the left piriform sinus, showing the narrowing of the glottic lumen and a large metastatic cervical lymph node ipsilateral.
believed to provide the highest cure and local control rates in patients with cancer of the hypopharynx.32–35 Even more important, surgery may immediately provide successful and long-lasting palliation for airway obstruction, obstructive dysphagia, and aspiration because local control is frequently achieved even in locally advanced cancer.36–40

Cancer of the Esophagus

In the United States in 2008, the American Cancer Society estimates an incidence of 16,470 new cases (12,970 men and 3500 women) of esophageal cancer; 14,280 persons (11,250 men and 3030 women) are expected to die of the disease. The age-adjusted incidence is 5.8 cases per 100,000 persons.41 Adenocarcinoma of the esophagus has the fastest growing incidence rate of all cancers in the United States. The prevalence is increasing by approximately 10% per year, which is faster than any other malignancy.42,43 This increase is largely secondary to the well-established association between gastroesophageal reflux disease, Barrett esophagus, and esophageal adenocarcinoma. Three studies have shown a relationship between frequency of reflux symptoms and risk of adenocarcinoma. The constant acid reflux will irritate the lining of the esophagus, and complications can occur, such as Barrett esophagus. Individuals who develop Barrett esophagus are about 40 times more likely to develop esophageal cancer than individuals in the general population. In Western countries, esophageal cancer has undergone an epidemiologic shift, from predominantly squamous cell carcinoma (SCC) seen in association with tobacco and alcohol abuse to adenocarcinoma associated with Barrett metaplasia, seen almost exclusively in middle-aged Caucasian men with gastroesophageal reflux disease.44 Symptoms of esophageal cancer include heartburn, pain or discomfort in the chest area, pain in the throat or between the shoulder blade, dysphagia with the inability to swallow solid foods, and regurgitation of undigested food, as well as severe weight loss. If esophageal carcinoma is suspected following characteristic clinical symptoms, a systematic approach to preoperative staging should include esophago-gastroduodenoscopy to obtain the histologic diagnosis of esophageal carcinoma, CT scan of the chest and abdomen, and endoscopic ultrasonography to evaluate the depth of tumor penetration.45 Surgical resection is the current standard of care for the treatment of patients with resectable esophageal carcinoma, with primary combined-modality therapy reserved for prohibitive surgical candidates. Earlier detection combined with complete surgical extirpation of disease and lower postoperative mortality have all contributed to improved survival, but survival rates still are poor, with an average 5-year overall survival rate of 20% to 25%.46–49

Foreign Body of the Hypopharynx or Esophagus

Aspiration of a foreign body or a large bolus of food commonly occurs in children, the elderly, demented people, and patients with esophageal stenoses. The most common foreign body is a fish bone, seen frequently in the ENT clinic. The fish bone is usually stuck in a tonsil or at the base of the tongue, but it may also get stuck in the hypopharynx and especially piriform sinus. In these locations, it is best extracted via rigid endoscopy under general anesthesia. All foreign bodies must be immediately extracted, as they may cause perforation of the mucosa with subsequent perforation of the pharynx or esophagus.

Neurologic Causes of Dysphagia

Neurologic causes of dysphagia include central causes such as stroke, Parkinson disease, or disseminated encephalitis. The diagnoses include electromyography
(EMG), and treatment options include botulinum toxin injection. Further, multiple system atrophy (such as amyotrophic lateral sclerosis) may be the disease underlying dysphagia and can be the first presenting symptom, so a neurologic workup is vital. 

Motor disorders are characterized by a delayed peristalsis of the esophagus, with consequent slow emptying into the stomach. Achalasia is an esophageal motility disorder characterized by the failure to relax the lower esophageal sphincter in response to swallowing. Primary achalasia, the most common form, has no known underlying cause. Achalasia can also be due to esophageal cancer or Chagas disease (an infectious disease common in South America). Achalasia affects about 1 person in 100,000 per year. Achalasia typically presents in the barium swallow radiograph with a dilated esophagus with a retained column of barium and a tight sphincter known as “bird’s beak.” Achalasia needs to be treated with a myotomy of the lower esophageal sphincter. Functional esophagogastric junction (EGJ) obstruction is characterized by pressure topography metrics demonstrating EGJ outflow obstruction of a magnitude comparable to that seen with post-fundoplication dysphagia. Affected patients experience dysphagia or chest pain. In some cases, functional EGJ obstruction may represent an incomplete achalasia syndrome.

**Psychogenic Dysphagia**

Last but not least, a globus sensation with concomitant dysphagia can be of psychogenic cause. If after the thorough diagnostic workup no pathologies are found, and the patient complains of a persistent dysphagia (which may not always be painful), an underlying psychogenic disease must be ruled out. The patient should then be referred to a psychiatrist who specializes in psychosomatic disorders for further diagnostics and therapy. Vaiman and colleagues studied the EMG examinations of such patients extensively. These investigators showed that psychogenic/hysteria-conversion dysphagia has no pathologic EMG patterns associated with deglutition. Skeletal muscle tension during deglutition, observed in some cases, has no connection with the act of swallowing itself.

**SPECIFIC METHODS OF DIAGNOSIS**

In all cases, a thorough and interdisciplinary approach can help to optimize diagnosis and treatment. The functional aspects of diagnostics are best shown by a videocine-matograph, which is a barium swallow examination recorded as a movie, so that the
treating physicians can slowly, repeatedly, and thoroughly envision the swallowing act of the patient. The radiologist may help identify the origin of the symptoms by interpreting the various radiographic findings in normal and abnormal states of the pharynx.59

The surgical equipment and specific otorhinolaryngologic instruments are shown in Figs. 6–8. Rigid esophagoscopes are available in different diameters and lengths, depending on the physical size of the patient. Direct laryngoscopes can be fixed during laryngoscopy, so the surgeon can operate bimanually under the operating microscope (Fig. 9). It is preferable to perform a rigid panendoscopy rather than a flexible endoscopy in particular cases. The benefits of using rigid instruments include the better unfolding of the mucosa in the hypopharyngeal region, which is additionally more effective in diagnosing a cancerous lesion; moreover, large and pointed foreign bodies (see Clinical Case 1) are more safely and readily extracted. There are numerous instruments specifically designed for the extraction of distinctive foreign bodies and biopsies in rigid endoscopy (see Fig. 6). The significance of rigid endoscopy is highlighted by a report on a failed extraction of a sharp esophageal foreign body with a flexible endoscope.60 Emphysema of the mediastinum and neck can be caused by a perforation of the hypopharynx or trachea as a complication of panendoscopy or,
as seen here, by a sharp foreign body aspiration, for example, dentures (Fig. 10 and Clinical Case 2). The choice of endoscope (rigid vs flexible) should therefore be dictated by the type of foreign body being removed and the location of the foreign body within the esophagus, as well as the experience of the surgeon.60

**Clinical Case 1**

A demented 84-year-old man had been denying any food intake for 2 weeks. This refusal was initially attributed to his dementia and diminished will for life. When he presented with fevers and drooling saliva, chest radiography was performed and revealed a boney mass at the height of the second esophageal sphincter. Rigid panendoscopy evacuated a 2 × 2-cm large chicken bone (Fig. 11). This bone had caused necrotic mucositis with perforation into the mediastinum.

**Clinical Case 2**

A 79-year-old woman presented from a nursing home with chest pain and aphagia that had been persisting for at least 24 hours. She was demented and had denied any food intake, with a progressive loss of the ability to swallow her saliva. Chest radiography was performed because of her rising temperature. The radiograph revealed a metallic mass in the hypopharynx. Rigid esophagoscopy was performed and showed partial dentures in the left piriform sinus, which were extracted by rigid pharyngoscopy without perforation of the hypopharynx. A nasogastric tube was placed and intravenous antibiotics were administered to prevent mediastinitis.

![Fig. 9. Direct laryngoscopy allows bimanual, microscopic surgery.](image)

![Fig. 10. Emphysema of the neck and mediastinum after perforation of the hypopharynx by a foreign body, with lateroposition of the trachea.](image)
SUMMARY

The various, at times life-threatening conditions causing dysphagia need to be ruled out in a patient presenting with this main symptom. It is thus crucial to perform a thorough history taking, physical examination, and radiologic diagnostic workup. A rigid panendoscopy under general anesthesia is used to diagnose and treat foreign bodies, and to facilitate staging and biopsy in suspected hypopharyngeal or esophageal cancer.

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