Oropharyngeal Dysphagia

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Current Treatment Options in Gastroenterology, 2000, **3:**77–87
Current Science Inc. ISSN 1092-8472

Opinion statement

- Oropharyngeal dysphagia (OPD) develops when a large number of local and systemic causes lead to abnormal oropharyngeal bolus transport and/or compromise of airway safety.
- Only a minority of cases of OPD are amenable to curative therapy.
- Rehabilitation of swallowing function is the cornerstone of therapy for the overwhelming majority of patients.
- Optimal management of oropharyngeal dysphagia requires a multidisciplinary approach involving a gastroenterologist, swallow/therapist, ENT physician, and rehabilitation and nutrition professionals, along with the support of family members.
- Therapy of OPD is directed at improvement of oropharyngeal bolus transport, ensuring adequate airway safety, and enhancing overall quality of life.
- A better understanding of the pathophysiologic basis of OPD has resulted in more efficacious therapy. However, given the large social and economic impact of OPD, continuing research is needed for development of better diagnostic and therapeutic modalities.

Introduction

Oropharyngeal dysphagia (OPD) occurs when the elaborate mechanism of oropharyngeal swallowing which, under normal circumstances, ensures complete transit of the bolus from the mouth into the esophagus and simultaneously protects the airway, becomes compromised. Aspiration pneumonia, malnutrition, and a diminished quality of life are among the untoward outcomes of OPD. While there are a large number of causes of OPD (Table 1), cerebrovascular accidents (CVA) account for the majority of cases, and aspiration pneumonia is a disproportionately common cause of mortality in these patients. [1]. Other neurologic conditions such as Parkinson's disease are responsible for numerous cases of OPD, with myopathic disorders and structural lesions making up the bulk of the remainder.

Despite the myriad causes of OPD, the pathophysiologic end result falls into one of two inter-related categories: 1) abnormalities of bolus transfer; and 2) abnormalities of airway protection. Abnormalities of bolus transfer can be further grouped into those caused by: 1) oropharyngeal pump failure; 2) oral/pharyngeal and pharyngo-UES discoordination; or 3) pharyngeal outflow obstruction. Abnormalities of airway protection may manifest themselves as pre-, intra-, and post-deglutitive aspiration. Whereas intra-deglutitive aspiration is usually caused by a defective deglutitive laryngeal closure mechanism, the pre-deglutitive aspiration is mainly caused by disorders affecting oral/pharyngeal transit and its coordination with deglutitive airway closure. Post-deglutitive aspiration for the most part results from pharyngeal outflow compromise and incomplete clearance. These distinctions carry with them important therapeutic implications. For instance, in a patient diagnosed with post-deglutitive aspiration, therapy will be directed to enhance UES deglutitive opening and improve pharyngeal clearance. In a patient diagnosed with intra-deglutitive aspiration, however, therapy will be directed at repairing/improving the closure mechanism of the larynx, whereas in a patient with pre-deglutitive aspiration postural tech-

Table 1. Causes Of Oral/Pharyngeal Dysphagia

Peripheral & Central Nervous System	Local/Structural Lesions
Cerebrovascular accident	Surgical resection of oropharynx/larynx
Head Injury	*Oropharyngeal carcinoma
Parkinson's disease	*Laryngeal carcinoma
Huntington's chorea	*Zenker's diverticulum
Multiple sclerosis	Extrinsic compression:
Amyotrophic-lateral sclerosis	*Enlarged thyroid gland
CNS tumor	Senile ankylosing hyperostosis
Tabes dorsalis	of the cervical spine
	Rheumatoid cricoarytenoid arthritis
Disorders of the central nervous system	Radiation injury
	(*eg*, Alzheimer's disease)
	Salivary gland damage
Bulbar poliomyelitis	*Cricopharyngeal achalasia
Peripheral neuropathies	
Post traumatic	*Cricopharyngeal bar & rings
Friedreich spastic ataxia	*Proximal esophageal webs
Familial dysautonomia	*Pharmacologic Agents
Muscular/Neuromuscular	Antihistamines
	Anticholinergics
Inflammatory muscle diseases	Phenothiazines
Polymyositis	
Dermatomyositis	Metabolic
Inclusion body myositis	
Muscular dystrophies	*Thyrotoxic associated myopathy
(including myotonic dystrophy)	*Cushing's Syndrome
Kearns-Sayre syndrome	Amyloidosis
Alcoholic myopathy	*Wilson's disease
Myasthenia gravis	

* Potentially reversible without rehabilition efforts.

niques, bolus modification and swallow maneuvers will need to be instituted.

In light of the wide array of clinical presentations, and a large number of patients with swallow-induced silent aspiration [2], the diagnosis of OPD requires a high index of suspicion. Some patients may be completely asymptomatic, whereas others may complain of difficulty swallowing, or demonstrate frequent throat clearing, repetitive swallowing, and hoarseness (Table 2). The investigating physician should seek out a history of recurrent pneumonia, weight loss, and regurgitation, as well as a garbled voice after meals, nasal regurgitation with meals, hoarseness, nasal speech, swallow-related coughing, and avoidance of social dining.

After a detailed history and a thorough examination specifically directed at neurologic and metabolic disorders and other specific causes of OPD, a modified barium swallow is typically used as the initial diagnostic test. Under fluoroscopy, this technique not only provides information about the movement of the barium bolus through the aerodigestive tract, but also documents misdirection of the bolus into the airway, provides vital information about the anatomy and function of individual components of the aerodigestive tract, and helps evaluate whether certain postural techniques and swallowing maneuvers are efficacious and safe for a particular patient. In our center, we now increasingly employ unsedated transnasal videoendoscopy, [3–5], an outpatient procedure that can easily be performed in the office setting or at the bedside. It is of particular utility in evaluation of patients with impaired mobility, and we have found it very useful in follow-up evaluation of patients undergoing swallow rehabilitation therapy. The diagnostic information afforded by this

Table 2. Symptoms of Oral/Pharyngeal Dysphagia

Inability to keep the bolus in the oral cavity
Difficulty gathering the bolus in the back of the tongue
Hesitation or inability to initiate the swallow
Food sticking in the throat
Nasal regurgitation
Inability to propel the food bolus caudad into the pharynx
Difficulty swallowing solids
Frequent repetitive swallowing
Frequent throat clearing
Gargly voice after meal
Hoarse voice
Nasal speech and dysarthria
Swallow related cough: before, during, or after swallowing
Avoidance from social dining
Weight loss
Recurrent pneumonia

technique is comparable to videofluoroscopy, and it also allows for pharyngeal laryngeal sensory testing. In addition, since the patient can observe oropharyngeal swallowing on the video screen, this technique is used to instruct patients on swallow rehabilitation, and to monitor treatment.

The treatment of a patient with OPD may range from manipulations of bolus size and consistency to surgical intervention consisting of cricopharyngeal myotomy. After the diagnosis of OPD is established, it is imperative to identify those cases that are amenable to curative treatment. These may include patients with proximal esophageal rings, webs, strictures, Zenker's diverticulum, drug-induced OPD, abnormalities of the cricopharyngeal (CP) opening, and metabolic disorders such as thyroid induced myopathy. Surgical intervention with CP myotomy appears to be most successful in patients with Zenker's diverticulum [6••] and other myopathic causes of UES-opening abnormalities. Unfortunately, these cases comprise a small minority of patients with OPD. The great majority require specialized rehabilitation of their swallowing function in order to maintain adequate nutrition and avoid airway compromise.

In these patients, therapy is directed by the diagnosed abnormalities of bolus transport and/or airway protective mechanisms. For instance, patients with OPD after CVA appear to have significant difficulty with thin liquids, and thus simple manipulation of bolus size and consistency such as use of thickening agents can be of great help. Furthermore, postural changes and swallowing maneuvers can be used to improve bolus transfer and airway safety. Table 3 outlines these techniques and maneuvers. With the assistance of a knowledgeable physician and swallow therapist, these techniques and maneuvers are used successfully to achieve a safe swallow.

Table 3. Postural Techniques and Swallowing Maneuvers

Postural Changes	Desired Effect
Chin tuck	Position bolus anteriorly & narrow airway entrance
Tilting head to stronger side	Gravitational forces direct bolus to stronger side
Head rotation to affected side	Takes advantage of stronger muscles on unaffected side to improve pharyngeal transfer
Chin up	Improve posterior movement of the bolus
Swallowing Maneuvers	
Multiple swallows	Residue is cleared with repeated effort
Supraglottic swallow	Close the true vocal cords and arytenoids and approximate the adducted arytenoids to the base of the epiglottis in order to prevent aspiration. The subsequent cough expels any contents which potentially may have penetrated the airway
Effort-full swallow	Increases posterior tongue thrust
Mendelsohn Maneuver	Prolongs UES opening and laryngeal elevation thus improving pharyngeal clearance
Shaker exercise	Increases cross-sectional area of UES opening Improves pharyngeal clearance and reduces/eliminates post-deglutitive aspiration

Treatment

Diet and lifestyle

- The patient's diet is dictated by the nature of his or her oropharyngeal dysphagia.

- While some patients can tolerate a regular diet, others require soft or pureed foods, because they cannot form a cohesive bolus, or they have a defective preparatory phase of swallowing. A simple intervention consists of manipulation of bolus size and consistency.
- However, dietary modification should not compromise the patient's pleasure in eating.
- Patients' families should be advised to make every effort to ensure desirability and palatability of meals by paying particular attention to taste, temperature, and texture, as well as being tolerant about the extra time required for some patients to eat properly.
- The overall goals of dietary intervention are to afford adequate nutrition while minimizing the sometimes dramatic personal and social ramifications of OPD, and thus allow patients to comfortably function within their social milieux.

Swallowing maneuvers

- The majority of OPD patients require specialized rehabilitation of their swallowing functions. Swallow therapy is performed with the aid of videofluoroscopy and more recently, with unsedated transnasal videoendoscopy. The therapy requires a cooperative patient with intact cognition.
- Swallow therapies (Table 3) are time-consuming, must be tailored to each individual patient and his or her specific oropharyngeal abnormalities, and, at times, require attempts at various techniques and maneuvers until an efficient and safe swallow is achieved.
- Swallowing maneuvers are used to improve bolus transfer and airway safety. In our practice, we find that they are more effective than postural techniques.
- Abnormalities of UES opening, which usually present with increased pharyngeal residue and post-deglutitive aspiration, respond to maneuvers that improve transphincteric transit (*eg*, Mendelsohn's maneuver, Shaker exercise).

Multiple swallows

Standard procedure The patient follows the swallow of each bite with two or three additional dry swallows.

Special points The desired effect: is the enhancement of pharyngeal closure and elimination of post-deglutitive pharyngeal residue. Target population: patients with post-deglutitive residue, poor pharyngeal peristalsis, and posterior tongue thrust.

Supraglottic swallow [8]

Standard procedure When ready to swallow, the patient takes in a deep breath, holds it, then swallows while bearing down, followed by a cough.

Special points The desired effect is to close the airway completely by adducting the vocal cords and arytenoids, and approximating the adducted arytenoids to the base of the epiglottis in order to prevent aspiration. The subsequent cough expels any contents that potentially may have penetrated the airway. Target population: patients with intra-deglutitive aspiration.

Mendelsohn's maneuver [9]

Standard procedure The patient is instructed to generate a sustained laryngeal and hyoid bone elevation following the swallow.

Special points The desired effect is to prolong UES opening, and thus enhance pharyngeal emptying. Target population: patients with abnormal pharyngeal transit and post-deglutitive aspiration.

Shaker exercise [10]

Standard procedure Isotonic and isometric head-raising exercise regimen in supine position, performed three times a day for a 6-week period [11,12].

Special points The desired effect is to increase the cross-sectional area of UES opening by strengthening the traction forces of the suprahyoid muscles responsible for UES opening, and thus improving pharyngeal clearance and eliminating aspiration. Target population: patients with abnormal UES function who present with post-swallow pharyngeal residue and aspiration.

Postural techniques

Standard procedure Postural changes employ altered angles and/or gravitational forces to allow safe passage of the bolus and therefore reduce or eliminate aspiration. The chin tuck, the chin up, the head rotation to the affected side, and tilting of the head to the stronger side are examples of postural techniques (Table 3).

Special points Abnormalities of oropharyngeal transit are often overlapping, and rehabilitation of the swallowing mechanism often requires use of a number of the swallowing maneuvers and postural techniques. In some instances, such as abnormalities of UES opening, a single approach using the Mendelsohn maneuver or the Shaker exercise may suffice.

Cost-effectiveness There is data to support the use of these measures [13]. Large, randomized, controlled trials are needed to establish the cost-effectiveness of these interventions and their method of delivery [14••]. For example, a recent randomized controlled trial found that limited patient and family instruction regarding the use of diet modification and swallowing techniques was just as effective in decreasing the incidence of complications as was intervention by a therapist to control diet consistency and provide daily rehearsal of compensatory swallowing techniques [15]. For this reason, the frequency of scheduled therapy sessions with health-care professionals should be re-evaluated, and increased family participation should be encouraged.

Pharmacologic treatment

- While as yet no specific pharmacologic treatment is available for enhancement of general oropharyngeal swallowing function, withdrawal of certain pharmacologic agents such as antihistamines, anticholinergics, and particularly phenothiazines may resolve medication-induced OPD.
- Pharmacologic therapy directed at a specific reversible etiology of OPD such as thyroid hormone replacement in patients with thyroid-induced myopathy resulting in OPD may result in resolution or amelioration of OPD.

Endoscopic therapy

- We use the modified barium swallow and unsedated transnasal videoendoscopy as complementary tools. They not only yield diagnostic information, but also indicate which therapeutic modalities will be most useful.
- In addition, both are well-suited for repeated evaluation of progress after initiation of rehabilitation therapy.

- Placement of gastrostomy or gastrojejunostomy feeding tubes to maintain nutrition as well as dilation of proximal esophageal lesions are other potential therapeutic roles of the endoscopist and to a lesser degree, the radiologist.

Modified barium swallow study [16•,17]

Standard procedure During this study (also called videofluoroscopic swallow study), real time videofluoroscopic recordings are made as the patient swallows a variety of boluses with different consistencies and volumes. The recordings are saved for subsequent slow motion and frame-by-frame analysis, and may be used for future comparisons to evaluate progress. Thus, it permits evaluation of the benefits of various postural techniques and swallowing maneuvers on the efficiency and safety of swallowing.

Contraindications Uncooperative patient or impaired cognition. May be difficult in patients with impaired mobility (*eg,* transportation problems).

Complications Aspiration of large amounts of barium is unusual (most reported cases are associated with inattentiveness), and allergy to barium sulfate is exceedingly rare. Risk of repeated radiation exposure is often cited, but is rarely an issue clinically.

Cost-effectiveness While the effectiveness of initial evaluation is established, the cost-effectiveness of repeated evaluation has not been investigated. The number and frequency of follow-up studies requires further evaluation.

Unsedated Transnasal Videoendoscopy (T-EG D) [4,5]

Standard procedure This is an outpatient procedure that can easily be performed in the office setting. A small-diameter endoscope, such as a laryngoscope or an ultrathin gastroscope, is inserted through the nose and positioned at the level of posterior nares. The patient is asked to swallow. During this swallow, normal features of pharyngeal seal, namely the adduction of the superior constrictor and postero/orad elevation of palate, seen as a bulging in the nasopharynx, are examined (Fig. 1). Then the scope is advanced to the level of free margin of the epiglottis, where the glottis is clearly seen and its closure function is examined by having the patient produce different vowels, cough, and perform the valsalva maneuver. Following this, a 5- to 10-ml water bolus colored with blue food dye is given through the mouth, and the patient is instructed to hold the bolus in the mouth for 20 seconds. During this time the back of the tongue is observed for development of unilateral or bilateral spill or entry of colored water into the airway. The presence of spill is seen in patients with abnormalities of the tongue and/or palate control (Fig. 2). Following this stage, the scope is withdrawn to the level of the posterior nares, and the patient is asked to swallow once. The scope is then immediately advanced to the level of the epiglottis, during which time, attention is paid to the presence or absence of blue staining of the retro palatal pharynx, indicative of nasal regurgitation due to abnormalities of the velopharyngeal closure mechanism. This abnormality may be caused by inadequate elevation and posterior movement of the soft palate and uvula. Then the inner aspect of the epiglottis, aryepiglottic fold, posterior commissure, and true vocal cords are examined for the presence or absence of staining.

In a study of normal volunteers in our laboratory, only the outer edges of the epiglottis and aryepiglottic-fold were stained with blue dye [18]. Coloring of the laryngeal vestibule indicates abnormal deglutitive airway protective mechanisms. Endotracheal coloring with blue dye can easily be seen, proving aspiration. In cases where endotrachael coloring has not been ascertained, the patients are asked to cough once. Since, the laryngeal vestibule remains open during a cough, expulsion of blue material from the trachea can be seen and is indicative of aspiration. Following this phase, the presence or absence of residue in the pyriform sinus and valleculae is determined, and overflow of residue into the trachea through the posterior commissure is sought. Swallows can be repeated for various volumes of liquid and solid foods as desired and indicated. If an ultrathin gastroscope is used, the esophagus can be easily evaluated in the same setting for possible causes of referred cervical dysphagic symptoms.

Contraindications Bleeding diathesis, impaired cognition, and abnormal nasal anatomy.

Complications Self-limited epistaxis (<1%).

Special points Permits evaluation of the esophagus for structural lesions along with potential therapy for structural lesions at the same time. Can be performed in the office setting or the bedside, a particular advantage in patients with impaired mobility. In patients in whom rehabilitation techniques do not achieve a safe swallow or cannot ensure adequate nutrition, placement of an endoscopic percutaneous feeding tube must be considered. These tubes may often be temporary while the patient undergoes further rehabilitation, and can be easily removed if a safe swallow is subsequently achieved.

Cost-effectiveness Has not been adequately studied. See modified barium swallow.

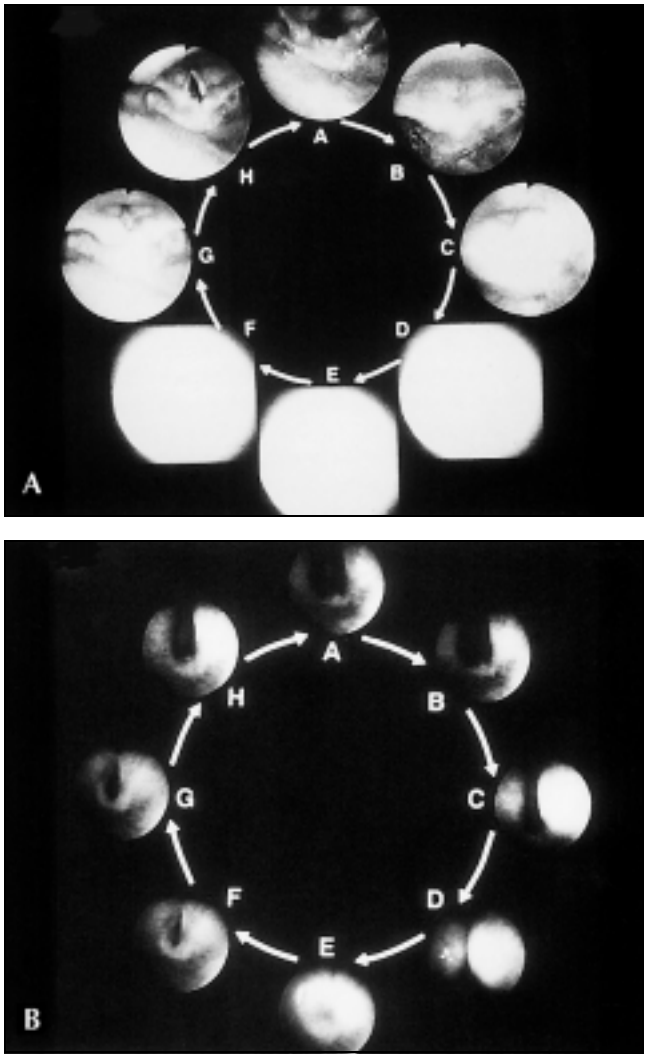

Figure 1. Examples of still frames of deglutitive vocal cord closure seen by unsedated transnasal videoendoscopy (A) in a normal volunteer, and (B) by transtracheal videoendoscopy in a patient with tracheostomy. (A -A) Glottis immediately before initiation of swallow. Vocal cords are open at their resting position. (B) Complete deglutitive vocal cord and arytenoid adduction. (C) Adducted arytenoids have approximated the base of the epiglottis. (D-F) Obscured view because of pharyngeal contraction and laryngeal elevation. (G) Vocal cords can be seen still adducted following the descent of the larynx and opening of the pharynx after passage of the bolus. (H) Vocal cords are beginning to open at the completion of swallow. (B-A) Inferior view of the glottis at rest. The introitus to the trachea is wide open immediately before the initiation of swallow. (B and C) Vocal cords are in the process of adduction narrowing the introitus. (D) Cords are in contact with each other in the anterior part. However, the posterior gap (arrow) is still open. (E) Posterior gap is now closed, resulting in complete closure of the introitus to the trachea. (F) Posterior gap is partially reopened while the anterior part of the cords are still in contact. (G and H) Cords are further opened returning to resting position. Please note that contrary to the transnasal view, in the transtracheal, the introitus to the trachea remained visible during the entire period of swallowing. (From Shaker R, Milbrath M, Ren J, *et al*.: Deglutitive aspiration in tracheostomy patients: effect of tracheostomy on the duration of vocal cord closure [31]. Reprinted with permission.)

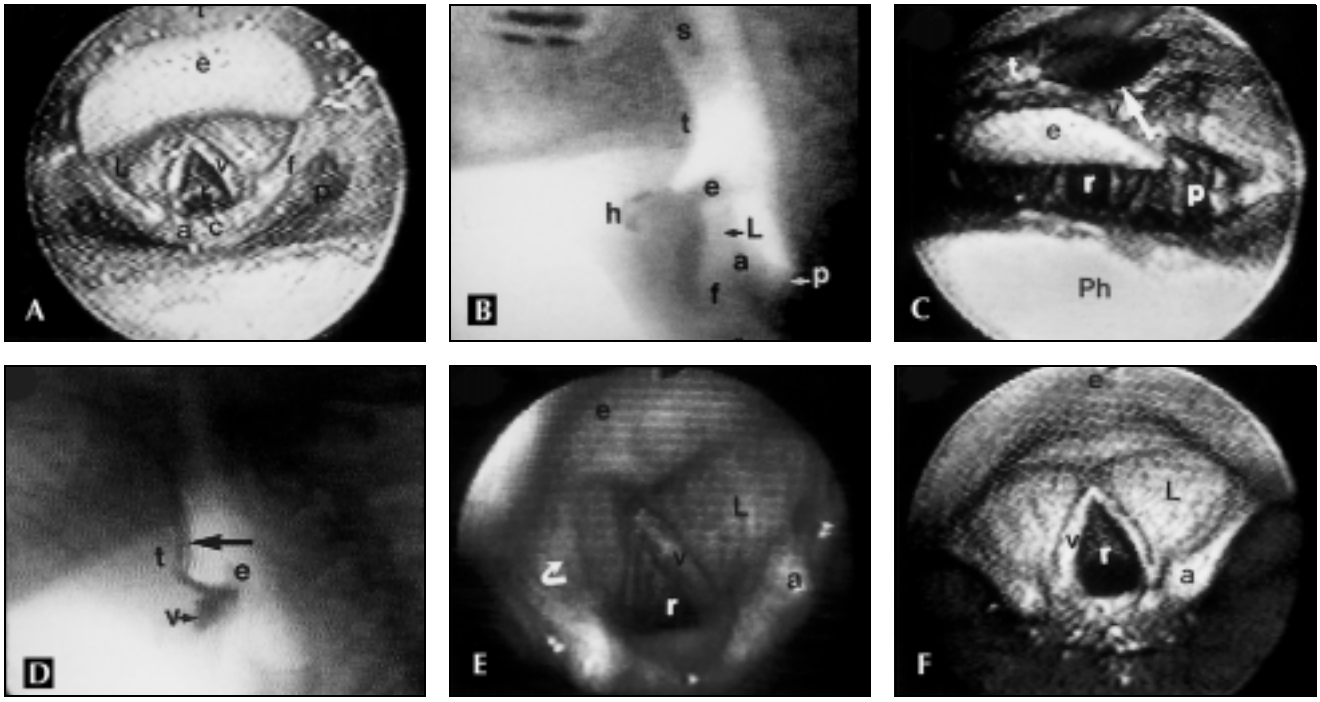

Figure 2. Top: Hypopharynx and glottis viewed by videoendoscopy (A) and videofluoroscopy (B). Although most of the anatomical structures involved in swallowing are visualized by both modalities, the hyoid bone is observed only by the x-ray technique, whereas vocal cords are visualized better by endoscopy. (a, arytenoid; c, posterior commissure; e, epiglottis; f, aryepiglottic fold; h, hyoid bone; L, laryngeal vestibule; p, pyriform sinus; r, trachea; s, soft palate; t, tongue; v, vocal cord. Middle: Still frames of videoendoscopic (A) and videofluoroscopic (B) views of premature spill (arrow) of oral bolus into the pharynx in an oropharyngeal dysphagic patient. On videofluoroscopy it is observed that the barium contrast spilled prematurely over the posterior aspect of the tongue and has filled the space between the posterior aspect of the tongue and anterior aspect of the free margin of the epiglottis (the vallecullae). Similarly, on videoendoscopy it is observed that the blue-colored water has entered the pharynx prematurely and is over the posterior aspect of the tongue entering the valleculae. (e, epiglottis; p, pyriform sinus; ph, posterior pharyngeal wall; r, trachea; t, posterior aspect of tongue; v, valleculae). Bottom: Endoscopic views of the glottis in a dysphagic patient (A) and a normal volunteer (B) after swallowing 5 mL of blue-colored water. As noted, the patient's vestibule is stained (arrow) after swallowing 5 mL of colored water, whereas the healthy volunteer's vestibule is not, except for staining of the edges. (a, arytenoids; e, epiglottis; L, laryngeal vestibule; r, trachea; v, vocal cord). (*From* Shaker R: Oropharyngeal dysphagia: practical approach to diagnosis and management [32]. Reprinted with permission.)

Percutaneous Endoscopic Gastrostomy (PEG) [19]

Standard procedure	Placed via standard push or pull techniques.
Contraindications	Ascites, marked bleeding diathesis, gastric or esophageal obstruction (not amenable to endoscopic dilatation). Relative: morbid obesity, extensive scarring of the anterior abdominal wall, portal hypertension with portal hypertensive gastropathy.
Complications	Major: necrotizing fascitis of anterior abdominal wall, peristomal leakage with peritonitis, hemorrhage. Minor: superficial wound infections, tube migration or extrusion, gastrocolic fistula, tube occlusion, electrolyte imbalance, tube feed-associated diarrhea.
Special points	Depending on local expertise, radiologic or surgical placement may also be employed. Structural lesions that may result in OPD include proximal esophageal webs or rings, anastamotic strictures as wells as cricopharyngeal (CP) achalasia. Wire-guided dilatation is of benefit in all of these lesions, although with CP achalasia it is the myogenic (lack of compliance) that typically responds long-term as opposed to the neurogenic variety. In ten OPD patients with either elevated upper esophageal sphincter resting pressure, a high residual pressure or attenuated duration of relaxation on swallowing, wire-guided dilatation with 18–20 mm bougies has been shown to decrease dysphagic symptoms, enhance nutrition and significantly diminish UES residual and resting pressure [20].

Cost-effectiveness Although expensive, PEG is considered indicated if long-term (at least 6 weeks) tube feeding is required.

Wire-guided esophageal dilatation

Standard procedure After endoscopic placement of a guidewire, under fluoroscopic monitoring, serial tapered polyvinyl bougies (American or Savary-Gilliard dilators) are passed to achieve desired effect. Repeat dilatations should be directed by response to initial dilatation, patient tolerance, and type of underlying lesion. In cases of proximal esophageal rings, acid-suppressive therapy following dilatation may be needed to avoid recurrence.

Contraindications Marked bleeding diathesis, fresh surgical anastamosis, uncooperative patient, contraindications to endoscopy, Relative: impacted bolus, recent large-bore biopsies, severe cervical arthritis.

Complications Performed properly and for the correct indications, we feel this is a very safe procedure with rare occurrences of perforation, bacteremia, or hemorrhage.

Special points Anastamotic strictures are notoriously difficult to manage. Triamcinolone acetonide diluted in sterile saline solution to a final concentration of 10 mg per milliliter and subsequently injected quadrantically in the narrowest portion of the stricture using a standard sclerotherapy needle up to total doses of 40 mg prior to dilation has been shown to allow for increased maximal dilation, increased interval between dilations, and a significant reduction in the total number of dilations required for patients [21–23].

Surgery

- Since it was first reported in the 1950s by Kaplan in a patient with OPD due to poliomyelitis,
  cricopharyngeal myotomy has been employed for a number of indications.
- The rationale for myotomy is to reduce or abolish resistance to flow of the bolus from the pharynx into the esophagus.
- It follows that it is most beneficial in patients who have outflow obstruction with an intact oropharyngeal pump.

Cricopharyngeal (CP) myotomy

Standard procedure While a number of different techniques are available, selection of a specific technique should be based on local expertise and experience.

Contraindications Usual surgical contraindications.

Complications Recurrent laryngeal nerve paralysis, pharyngeal leak, fistula formation, and perioperative pneumonia have all been reported [26].

Special points The success rates of this procedure have been reported in the 70% to 80% range. However, it appears that these rates are heavily dependent upon the indication. Myotomy appears to work extremely well for Zenker's diverticulum [6••], gives good results for disorders that result in reduced pliability of the UES, but yields unpredictable benefit in neuropathic disorders. In fact, studies have shown that patients who do have good pharyngeal propulsion respond well to myotomy, whereas those who lack such adequate pharyngeal contraction relapse or do not respond [24]. While other techniques for repair of Zenker's diverticulum are available, it is clear that cricopharyngeal myotomy must be performed at the same time or the diverticulum will recur [25•]. Whether cricopharyngeal myotomy, which ablates a major barrier to reflux of gastric acid, predisposes the dysphagic patient to esophago-pharyngeal reflux of gastric contents and subsequent aspiration and post-operative pulmonary complications, is a concern that has not been systematically studied. It may well be that patients with documented esophago-pharyngeal reflux should undergo fundoplication procedures along with their cricopharyngeal myotomy in order to prevent aspiration. A recent paper says this is not necessary, however.

Cost-effectiveness Although its cost-effectiveness has not been rigorously studied, for the proper indication (*eg,* Zenker's diverticulum), CP myotomy remains the therapy of choice.

Vocal cord augmentation [27]

Standard procedure Surgical injection of material into peri-laryngeal structures (*eg,* the lateral thyroarytenoid muscle) results in bulk formation at the injection site. This displaces the true cord in a fixed position toward the midline, facilitating closure during swallowing since the adduction of the functioning cord will result in contact of the two cords and closure of the introitus of the trachea. If the underlying problem is considered temporary, absorbable material (*eg,* gel foam, collagen, fat) may be injected directly into the vocal cord. If there is no expectation of resolution, Teflon, which is nonabsorbable and not easily removed, is used [28].

Contraindications Usual surgical contraindications.

Complications Inadequate response in patients with larger pharyngeal defects. These patients may require more extensive surgical intervention.

Special points Target population: Successfully used to prevent aspiration in patients with inadequate deglutitive glottal closure mechanism due to mechanical impairment, or due to neuromuscular conditions such as Parkinson's disease or amyotrophic lateral sclerosis, or various types of recurrent laryngeal nerve paralysis as a result of various central nervous system, surgical, or inflammatory disorders. Works best in those with mild aspiration.

Cost-effectivenes Has not been rigorously studied.

Emerging therapies

Botulinum Toxin (BoTox) injection

Treatment of OPD with Botulinum Toxin has been advocated in specific circumstances such as CP achalasia [29].

While some consider these results promising, we have reservations in light of the potential for vocal cord paralysis and airway compromise.

Although we are unaware of any such reported cases, it has been reported that up to 25% of the toxin injected can be found in adjacent muscles, having crossed the muscle fascia [30].

In light of the availability of less potentially harmful modalities, we do not advocate the use of this therapy at this time.

References and Recommended Reading

Papers of particular interest, published recently, have been highlighted as:
- • Of special interest
- •• Of outstanding interest

1. Croghan JE, Burke EM, Caplan S, Denman S: **Pilot study of 12-month outcomes of nursing home patients with aspiration on videofluoroscopy.** *Dysphagia* 1994, **9:**141–146.
2. Daniels SK, Brailey K, Priestly DH, *et al.*: **Aspiration in patients with acute stroke.** *Arch Phys Med Rehabil* 1998, **79:**14–19.
3. Staff D, Shaker R: Oropharyngeal dysphagia and associated disorders. In *Clinical Practice of Gastroenterology,* Vol. 1. Edited by Brandt LJ. Philadelphia: Current Medicine, Inc.; 1998: 66–74.
4. Langmore SE, Schatz K, Olsen N: **Fiberoptic endoscopic examination of swallowing safety: A new procedure.** *Dysphagia* 1988, **2:**216–219.
5. Bastian RW: **Videoendoscopic evaluation of patients with dysphagia: An adjunct to the modified barium swallow.** *Otolaryngol Head Neck Surg* 1991, **104:**339–350.

6.•• Shaw DW, Cook IJ, Jamieson GG, *et al.*: **Influence of surgery on deglutitive upper oesophageal mechanics in Zenker's diverticulum.** *Gut* 1996, **38(6):**806–811.
Demonstrated that poor baseline UES compliance in patients with Zenker's diverticulum is normalized by surgery and further established the importance of cricopharyngeal myotomy has a mandatory component of surgery for Zenker's diverticulum.

7.• Logeman JA: Therapy for oropharyngeal swallowing disorders. In *Deglutition and Its Disorders.* Edited by Perlman AL, Schulze-Delrieu KS. San Diego: Singular Publishing Group; 1997:449–462.
A succinct chapter outlining available swallow therapies and their mechanism of action.

8. Martin BJW, Logemann JA, Shaker R, *et al.*: **Normal laryngeal valving patterns during three breath hold maneuvers: A pilot investigation.** *Dysphagia* 1993, **8:**11–20.

9. Bartolome G, Neuman DS: **Swallowing therapy in patients with neurological disorders causing cricopharyngeal dysfunction.** *Dysphagia* 1993, **8:**146–149.

10. Bucholz DW, Neumann S: **Comments on selected recent dysphagia literature.** *Dysphagia* 1999, **14:**113–115.

11. Shaker R, Kern M, Bardan E, *et al.*: **Augmentation of deglutitive upper esophageal sphincter opening in the elderly by exercise.** *Am J Physiol* 1997, **272:**G1518–G1522.

12. Easterling C, Kern M, Nitschke T, *et al.*: **Effect of a novel exercise on swallow function and biomechanics in tube fed cervical dysphagia patients: A preliminary report.** *Dysphagia* 1999, **14:**119.

13. Odderson IR, Keaton JC, McKenna BS: **Swallow management in patients on an acute stroke pathway: quality is cost-effective.** *Arch Phys Med Rehabil* 1995, **76(12):**1130–1133.

14.•• Cook IJ, Kahrilas PJ: **AGA technical review on management of oropharyngeal dysphagia.** *Gastroenterology* 1999, **116(2):**455–478.
An extensive, up-to-date review of oropharyngeal dysphagia with analysis of available studies and evidence-based management recommendations.

15. DePippo KL, Holas MA, Reding MJ, *et al.*: **Dysphagia therapy following stroke: A controlled trial.** *Neurology* 1994, **44:**1655–1660.

16.• Dodds WJ, Logemann JA, Stewart ET: **Radiologic assessment of abnormal oral and pharyngeal phases of swallowing.** *Am J Roentgenol* 1990, **154:**965–974.
An excellent summary of radiologic findings in patients with oropharyngeal dysphagia.

17. Dodds WJ, Stewart EG, Logemann JA: **Physiology and radiology of the normal oral and pharyngeal phases of swallowing.** *Am J Roentgenol* 1990, **154:**953–963.

18. Shaker R, Bowser M, Hogan WJ, *et al.*: **Videoendoscopic characterization of abnormalities in pharyngeal phase of swallowing [Abstract].** *Gastroenterology* 1991, **100:**A494.

19. Larson DE, Burton DD, Schroeder KW, *et al.*: **Percutaneous endoscopic gastrostomy: Indications, success, complications, and mortality in 314 consecutive patients.** *Gastroenterology* 1987, **93:**48-52.

20. Hatlebakk JG, Castell JA, Spiegel J, *et al.*: **Dilatation therapy for dysphagia in patients with upper esophageal sphincter dysfunction - manometric and symptomatic response.** *Dis Esophagus* 1998, **11:**254–259.

21. Lee M, Kubik CM, Polhamus CD, *et al.*: **Preliminary experience with endoscopic intralesional steroid injection therapy for refractory upper gastrointestinal strictures.** *Gastrointest Endosc* 1995, **41:**598–601.

22. Zein NN, Greseth JM, Perrault J: **Endoscopic intralesional steroid injections in the management of refractory esophageal strictures.** *Gastrointest Endosc* 1995, **41:**596–598.

23. Burdick JS, Hogan WJ, Massey BT, *et al.*: **Triamcinolone injections decrease the need for dilation of rapidly recurring esophageal strictures [Abstract].** *Gastrointest Endosc* 1994, **40:**72.

24. Bucholz DW: **Cricopharyngeal myotomy may be effective treatment for selected patients with neurogenic oropharyngeal dysphagia.** *Dysphagia* 1995, **10:**255–258.

25.• Kelly JH: **External approach to cricopharyngeal muscle (CP) myotomy.** *Op Tech Otolaryngol-Head Neck Surg* 1997, **8:**193–198.
A brief description of the surgical technique of external cricopharyngeal myotomy as well as indications, contraindications, and complications of the procedure.

26. Campbell BH, Tuominen TC, Toohill RJ: **The risk and complications of aspiration following cricopharyngeal myotomy.** *Am J Med* 1997, **103(SA):**61S–63S.

27. Ergun GA, Kahrilas PJ: Medical and surgical treatment interventions in deglutitive dysfunction. In *Deglutition and Its Disorders.* Edited by Perlman AL, Schulze-Delrieu KS. San Diego: Singular Publishing Group; 1997:463–490.

28. Ward PH, Hanson DG, Abemajor E: **Transcutaneous Teflon injection of the paralyzed vocal cord: A new technique.** *Laryngoscope* 1985, **95:**644-649.

29. Blitzer A, Brin ME: **Use of botulinum toxin for diagnosis and management of cricopharyngeal achalasia.** *Otolaryngol Head Neck Surg* 1997, **116:**328–330.

30. Shaari G, George E, Wi B, *et al.*: **Quantify in the spread of botulinum toxin through muscle fascia.** *Laryngoscope* 1991, **101:**960–964.

31. Shaker R, Milbrath M, Ren J, *et al.*: **Deglutitive aspiration in tracheostomy patients: effect of tracheostomy on the duration of vocal cord closure.** *Gastroenterology* 1995, **108:**1357–1360.

32. Shaker R: **Oropharyngeal dysphagia: practical approach to diagnosis and management.** *Semin Gastrointest Dis* 1992, **3(3):**115–128.