

American College of Radiology ACR Appropriateness Criteria®

Clinical Condition: Dysphagia

Variant 1: Oropharyngeal dysphagia with an attributable cause.

Radiologic Procedure	Rating	Comments	RRL*
X-ray barium swallow modified	8		☼ ☼ ☼
X-ray pharynx dynamic and static imaging	6		☼ ☼ ☼
X-ray biphasic esophagram	4	Perform this procedure with double contrast and single contrast.	☼ ☼ ☼
X-ray barium swallow single contrast	4		☼ ☼ ☼
Tc-99m transit scintigraphy esophagus	2		☼ ☼ ☼
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 2: Unexplained oropharyngeal dysphagia.

Radiologic Procedure	Rating	Comments	RRL*
X-ray pharynx dynamic and static imaging	8	In this procedure both pharyngeal and esophageal examinations are needed since the patient may have referred dysphagia.	☼ ☼ ☼
X-ray biphasic esophagram	8	In this procedure both pharyngeal and esophageal examinations are needed since the patient may have referred dysphagia. Perform this procedure with double contrast and single contrast.	☼ ☼ ☼
X-ray barium swallow modified	6		☼ ☼ ☼
X-ray barium swallow single contrast	6		☼ ☼ ☼
Tc-99m transit scintigraphy esophagus	4		☼ ☼ ☼
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 3: Retrosternal dysphagia in immunocompetent patients.

Radiologic Procedure	Rating	Comments	RRL*
X-ray biphasic esophagram	8	Endoscopy and biphasic esophagram are both excellent diagnostic tests in this setting.	☼ ☼ ☼
X-ray barium swallow single contrast	6	This procedure is probably indicated if the patient is not capable of doing anything except swallowing.	☼ ☼ ☼
X-ray barium swallow modified	4		☼ ☼ ☼
X-ray pharynx dynamic and static imaging	4	Esophageal examination is also necessary.	☼ ☼ ☼
Tc-99m transit scintigraphy esophagus	4		☼ ☼ ☼
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Clinical Condition: Dysphagia

Variant 4: Retrosternal dysphagia in immunocompromised patients.

Radiologic Procedure	Rating	Comments	RRL*
X-ray biphasic esophagram	8	Endoscopy and biphasic esophagram are both excellent diagnostic tests in this setting.	☼ ☼ ☼
X-ray barium swallow single contrast	5		☼ ☼ ☼
X-ray barium swallow modified	4		☼ ☼ ☼
X-ray pharynx dynamic and static imaging	3	Esophageal examination is also necessary.	☼ ☼ ☼
Tc-99m transit scintigraphy esophagus	2		☼ ☼ ☼
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

DYSPHAGIA

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Summary of Literature Review

Introduction/Background

According to *Stedman's Medical Dictionary* and *Dorland's Medical Dictionary*, "Dysphagia" is defined as "difficulty in swallowing." Dysphagia is also a symptom, defined as the "subjective awareness of swallowing difficulty during passage of a liquid or solid bolus from the mouth to the stomach." As a symptom, it is usually indicative of an abnormality in the function or structure of the organs involved in swallowing or those involved in swallowing, breathing, and speech interaction.

Dysphagia affects up to 22% of adults in the primary care setting and is more likely in older adults [1,2]. Adults over age 65 may account for up to two-thirds of all people with dysphagia [1]. Although the aging process is associated with neuromuscular changes, aging itself does not typically cause clinically significant dysphagia. However, aging is associated with an increased prevalence of neuromuscular and degenerative disorders that can cause dysphagia, therefore the presence of dysphagia should prompt evaluation [1,3]. It is also important to note that a person may have a swallowing problem but not be symptomatic. In one study of 2,000 patients evaluated with videofluoroscopic examinations, 51% of patients were found to aspirate; however, of those who aspirated, 55% demonstrated silent aspiration with an absent protective cough reflex [4].

Dysphagia can be caused by functional or structural abnormalities of the oral cavity, pharynx, esophagus, or even the gastric cardia. Many patients with dysphagia can subjectively localize a sensation of blockage or discomfort to the throat or to the retrosternal region. Patients with pharyngeal dysphagia typically complain of food sticking in the throat or of a globus sensation with a lump in the throat. Other symptoms of oropharyngeal dysfunction include coughing or choking during swallowing (due to laryngeal penetration or aspiration), a nasal-quality voice or nasal regurgitation (due to soft-palate insufficiency), food dribbling from the mouth, and difficulty initiating a swallow or chewing (due to an abnormal oral phase of swallowing). It also is important to recognize that abnormalities of the mid or distal esophagus or even the gastric cardia may cause referred dysphagia to the upper chest or pharynx, whereas abnormalities of the pharynx rarely cause referred dysphagia to the lower chest [5]. Therefore, the esophagus and cardia should be evaluated in patients with pharyngeal symptoms, particularly if no abnormalities are found in the pharynx to explain these symptoms. Other patients may have retrosternal dysphagia with a sensation of blockage or discomfort anywhere from the thoracic inlet to the xiphoid process. This symptom may be caused by esophageal motility disorders or by structural abnormalities of the esophagus or cardia such as esophagitis, rings, strictures, or tumors.

Overview of Imaging Modalities

Radiologic evaluation in patients with dysphagia should be tailored to assess the oral cavity, pharynx, esophagus, and/or gastric cardia based on the level of clinical suspicion. Fluoroscopy remains the imaging modality of choice to evaluate dysphagia. Fluoroscopic studies can be used to assess pharyngeal function and esophageal motility while simultaneously assessing for structural disorders including webs, rings, strictures, extrinsic mass effect, and tumors.

Overall, the test choice may depend on the nature and location of the patient's dysphagia as well as the clinical setting. For example, in the immediate postoperative scenario, the preferred method of radiographic evaluation

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may be a single contrast study using water-soluble contrast such as diatrizoate meglumine and diatrizoate sodium solution (Gastrografin[®]) or iohexol (Omnipaque[®]), rather than barium sulfate.

X-ray Pharynx, Including Dynamic and Static Imaging

A biphasic examination of the esophagus and pharynx is performed (similar to a biphasic esophagram) by acquiring static and dynamic images of the pharynx. In addition to double- and single-contrast images of the pharynx, videofluoroscopy of swallowing phases aids in the evaluation of swallowing disorders. Pharyngeal function and esophageal motility are also assessed.

X-ray Modified Barium Swallow

A modified barium swallow is a videofluoroscopic procedure performed in conjunction with a speech therapist to evaluate a patient's oropharyngeal swallow and to examine the effectiveness of rehabilitation strategies [6]. The modified barium swallow uses videofluoroscopy to focus on the oral cavity, pharynx, and cervical esophagus to assess for oral and pharyngeal swallowing phases abnormalities. Various barium suspensions and consistencies may be used, and compensatory maneuvers (eg, head position changes and breathing techniques) may be attempted to prevent aspiration or improve other types of swallowing dysfunction [6].

X-ray Barium Swallow—Single-Contrast Esophagram

A single-contrast esophagram or barium swallow includes full-column distension, mucosal relief views, and fluoroscopic observation. Single-contrast technique allows for the assessment of esophageal and pharyngeal function and motility. Evaluation of mucosal detail is superior with double-contrast technique; however, single-contrast studies are well-suited for elderly, debilitated, obese, and postoperative patients as well as patients who are unable to fully cooperate with the biphasic examination.

X-ray Biphasic Esophagram

A biphasic fluoroscopic evaluation of the pharynx and esophagus includes single- and double-contrast techniques, including full-column, mucosal relief, and double-contrast views of the esophagus [7,8]. Esophageal function and motility are evaluated at fluoroscopy. Double-contrast technique provides more mucosal detail compared with the single-contrast technique. Additionally, sensitivity to detect mucosal disease is highest with the double-contrast technique [8]. However, patient cooperation and mobility are required.

Tc-99m Transit Scintigraphy Esophagus

Nuclear scintigraphy may be useful to assess esophageal transit. Tc-99m labeled substances may be mixed in liquid, semisolid, or solid form and swallowed in conjunction with dynamic image acquisition. This examination could be used to assess for motility abnormalities or gastroesophageal reflux. Other possible diagnostic tests to evaluate patients with dysphagia include endoscopy and manometry. Dynamic magnetic resonance (MR) imaging acquired during swallowing (MR fluoroscopy) can assess swallowing function, esophageal motility, and the function and morphology of the gastroesophageal junction without ionizing radiation [9,10]. Dynamic computed tomography to assess swallowing has also been reported [11,12]. However, the use of these modalities to evaluate dysphagia has not yet been widely accepted.

Discussion of Imaging Modalities by Variant

Optimal evaluation of patients with dysphagia depends on the nature and location of the dysphagia and the clinical setting. For example, when oropharyngeal dysphagia has an attributable cause (eg, recent stroke), a modified barium swallow with different bolus consistencies may be the appropriate test to assess the patient's swallowing status and initiate treatment by a speech therapist. Patients with unexplained oropharyngeal dysphagia, however, may need a more detailed barium study to determine the cause. Also, because abnormalities of the distal esophagus or gastric cardia can cause referred sensation of dysphagia in the upper chest or pharynx, the esophagus and cardia should be evaluated in patients with pharyngeal symptoms, and a combined radiologic examination of the oral cavity, pharynx, esophagus, and gastric cardia is appropriate for patients with unexplained pharyngeal dysphagia.

Patients with retrosternal dysphagia experience a sensation of blockage or discomfort at any level between the thoracic inlet and the xiphoid process. Because retrosternal dysphagia can be caused by esophageal motility disorders or by structural abnormalities of the esophagus or cardia (ie, esophagitis, rings, strictures, or tumors) a biphasic esophagram is the preferable procedure. Biphasic barium examination includes upright double-contrast views with a high-density barium suspension to assess mucosal disease as well as prone single-contrast views

with a low-density barium suspension to assess distensibility and motility and to evaluate for the presence of a hiatal hernia.

Four scenarios are considered separately:

1. Oropharyngeal dysphagia with an attributable cause
2. Unexplained oropharyngeal dysphagia
3. Retrosternal dysphagia in immunocompetent patients
4. Retrosternal dysphagia in immunocompromised patients

Oropharyngeal Dysphagia With an Attributable Cause

When oropharyngeal dysphagia has an attributable cause (eg, recent stroke, worsening dementia, myasthenia gravis, amyotrophic lateral sclerosis), there is a high index of suspicion for swallowing dysfunction, and modified barium swallow is the study of choice. The risk of developing aspiration pneumonia is directly related to the degree of swallowing dysfunction on videofluoroscopic studies [13].

A modified barium swallow may be performed with the assistance of a speech therapist; in that case, the study is facilitated by examining the patient in a speech therapy chair [6]. The modified barium swallow focuses on the oral cavity, pharynx, and cervical esophagus with videofluoroscopy to assess abnormalities of both the oral phase of swallowing (ie, difficulty propelling the bolus) and the pharyngeal phase (ie, laryngeal penetration, tracheal aspiration, cricopharyngeal dysfunction). Dynamic evaluation of swallowing function can assess bolus manipulation, tongue motion, hyoid, laryngeal, and pharyngeal elevation, soft-palate elevation, pharyngeal constrictor motion, epiglottic tilt, laryngeal penetration, and cricopharyngeus muscle function. The patient may be given high-density or low-density barium suspensions as well as other substances of varying consistency (eg, barium paste or barium-impregnated crackers) to assess the patient's ability to swallow solid or semisolid substances. In conjunction with a speech therapist, various compensatory maneuvers (eg, a chin-tuck position) may be attempted to prevent aspiration or improve other types of swallowing dysfunction [6].

The x-ray evaluation of the pharynx with dynamic and static imaging may also evaluate swallowing function; however, this examination typically does not involve a variety of barium consistencies and does not include an evaluation of therapeutic options. Biphasic or single-contrast examinations may be used to diagnose aspiration or penetration and structural abnormalities; however, these studies do not allow for a detailed evaluation of swallowing function. Nuclear scintigraphy is usually not indicated in this clinical scenario.

Unexplained Oropharyngeal Dysphagia

In patients with unexplained oropharyngeal dysphagia, a more detailed barium study may be performed to assess both functional and structural abnormalities of the pharynx (ie, x-ray pharynx with dynamic and static imaging) [8,14]. As in the modified barium swallow, a dynamic examination of the pharynx with videofluoroscopy permits assessment of the oral and pharyngeal swallowing phases. However, static images of the pharynx (eg, double-contrast spot films of the pharynx in frontal and lateral projections with high-density barium) should also be obtained to detect structural abnormalities (eg, pharyngeal tumors, Zenker diverticulum). Because some patients with lesions in the esophagus or at the gastric cardia can have referred dysphagia, the esophagus and cardia should also be carefully evaluated as part of the barium study, particularly if no abnormalities are found in the pharynx to account for patients' symptoms [8,15]. In addition, patients with pharyngeal carcinomas have a significantly increased risk of synchronous esophageal carcinomas; complete examination of the esophagus should be performed once a pharyngeal tumor is identified [8].

In patients with unexplained pharyngeal dysphagia, the combination of videofluoroscopy and static images of the pharynx and esophagus has a higher diagnostic value than either videofluoroscopy (such as a modified barium swallow) or static images (such as a biphasic or single-contrast esophagram) alone [16]. If a study is performed using solely static imaging, a biphasic study is preferable to a single-contrast barium swallow due to its superior depiction of mucosal processes.

Retrosternal Dysphagia in Immunocompetent Patients

The biphasic esophagram is a valuable technique for evaluating retrosternal dysphagia in immunocompetent patients [8]. This technique permits detection of both structural and functional abnormalities of the esophagus. Structural lesions include esophagitis, strictures, rings, and carcinoma. Functional abnormalities of the esophagus include reflux and motility disorders.

The most important structural lesion is carcinoma of the esophagus or esophagogastric junction. In one study, biphasic esophagography was found to have 96% sensitivity in diagnosing cancer of the esophagus or esophagogastric junction [17], comparable to the reported sensitivity of endoscopy for diagnosing these lesions. In 2 other large patient series, endoscopy failed to reveal any cases of esophageal carcinoma that had been missed on the barium studies [18,19]. The findings in these series suggest that endoscopy is not routinely warranted to rule out missed tumors in patients who have normal findings on radiologic examinations.

Although double-contrast views best detect mucosal lesions (eg, tumors, esophagitis), prone single-contrast views of patients who continuously drink a low-density barium suspension best detect lower esophageal rings or strictures. Lower esophageal rings are 2–3 times more likely to be diagnosed on prone single-contrast views than on upright double-contrast views because of inadequate distention of the distal esophagus when the patient is upright [7,20]. In one study, the biphasic esophagram was found to depict about 95% of all lower esophageal rings, whereas endoscopy detected only 76% of these rings [20]. Similarly, biphasic esophagrams have been found to have a sensitivity of about 95% for the detection of peptic strictures, sometimes revealing strictures that are missed with endoscopy [21,22].

The biphasic esophagram is also a useful test in patients with esophageal motility disorders causing dysphagia. Videofluoroscopy of discrete swallows of a low-density barium suspension in the prone right antero-oblique position permits detailed assessment of esophageal motility. In various studies, videofluoroscopy has been found to have an overall sensitivity of 80%–89% and specificity of 79%–91% for diagnosing esophageal motility disorders (eg, achalasia, diffuse esophageal spasm) compared with esophageal manometry [23,24]. Occasionally, barium studies may even reveal dysmotility not seen at manometry (eg, some patients with the beak-like distal esophageal narrowing of achalasia are found to have complete relaxation of the lower esophageal sphincter on manometry) [25]. In any case, when a significant esophageal motility disorder is detected on a barium study, manometry may be performed to further elucidate the nature of this motility disorder.

Although the biphasic esophagram provides superior mucosal detail, allowing for earlier detection of subtle lesions, patient cooperation and mobility are required. For debilitated, immobile patients or patients who are limited in their ability to cooperate, a single-contrast esophagram may be necessary.

For patients with retrosternal dysphagia, the entire esophagus and the gastric cardia should be assessed. Therefore, modified barium swallow and dynamic imaging of the pharynx (x-ray pharynx dynamic and static imaging) may not be appropriate.

Known or suspected achalasia (pretreatment or post-treatment) is a subcategory within the “retrosternal dysphagia in the immunocompetent patient” section of text. Specific protocols to assess esophageal emptying are useful [26,27]. It should be determined that the patient does not aspirate thin liquids before he or she is given large quantities of barium. Alternatively, radionuclide esophageal transit scintigraphy is a simple, noninvasive, and quantitative test of esophageal emptying [1,28,29].

Endoscopy performed to evaluate the esophagus for structural abnormalities in patients with dysphagia is a highly accurate test for esophageal cancer when multiple endoscopic biopsy specimens and brushings are obtained. It also is more sensitive than double-contrast esophagography for detecting mild reflux esophagitis or other subtle forms of esophagitis. However, endoscopy is a more expensive and invasive test than the barium study. It also is less sensitive than the barium study for detecting lower esophageal rings or strictures [7,20-22] and does not permit evaluation of esophageal motility disorders. For these reasons, the barium study is often recommended, even by gastroenterologists, as the initial diagnostic test for patients with dysphagia [1,3,8,30,31].

Retrosternal Dysphagia in Immunocompromised Patients

The major consideration in immunocompromised patients with dysphagia or odynophagia (painful swallowing) is infectious esophagitis, most commonly due to *Candida albicans* or herpes simplex virus. In HIV-positive patients, *Candida* is most often the cause of esophageal symptoms; cytomegalovirus (CMV), herpes simplex, and idiopathic ulcers (also known as HIV ulcers) are the other most common etiologies [32-35]. HIV-positive patients with esophageal symptoms may be treated empirically with antifungal therapy without first undergoing a diagnostic examination [34,36]. However, most gastroenterologists prefer that those who have severe symptoms at presentation or persistent symptoms be evaluated by endoscopy [32,34]. Endoscopy is preferred because of the ability to obtain specimens (eg, histology, cytology, immunostaining, or culture) [1,32]. The endoscopic or

radiographic appearance alone usually does not accurately predict diseases other than *Candida* esophagitis; diagnosis requires specimen acquisition for laboratory study [32-35].

Esophagography is preferred by some as an initial diagnostic study and can be useful in guiding management. Biphasic esophagography is more accurate than single-contrast esophagography for detecting ulcers or plaques associated with infectious esophagitis [37-42]. However, a single-contrast esophagram may be performed if the patient is too sick or debilitated to tolerate a double-contrast examination. Patients with radiographically diagnosed *Candida* or herpes esophagitis may be treated with antifungal or antiviral agents respectively, without endoscopic evaluation. Endoscopy is warranted for patients with giant esophageal ulcers to differentiate CMV and HIV and begin appropriate therapy [34,41].

Dynamic evaluation of swallowing function, as with modified barium swallow or x-ray pharynx with dynamic and static views may not be necessary in this clinical scenario, and a modified barium swallow may fail to reveal the diagnosis. Nuclear scintigraphy evaluates esophageal transit and is likely not indicated in this scenario.

Summary

- If there is an attributable cause for oropharyngeal dysphagia, a modified barium swallow study is recommended. Various barium suspensions and consistencies may be used. With the assistance of a speech therapist, compensatory maneuvers can be attempted.
- If oropharyngeal dysphagia is unexplained, a more detailed barium study should be performed incorporating a combination of videofluoroscopy and static images of the pharynx and esophagus with evaluation made of the pharynx, esophagus, and gastric cardia.
- When assessing retrosternal dysphagia in immunocompetent patients, the biphasic esophagram is the imaging study of choice. Double-contrast views best detect mucosal lesions, whereas single-contrast views best detect lower esophageal rings or strictures and assess motility.
- In immunocompromised patients with retrosternal dysphagia, a biphasic examination is necessary to detect more subtle changes of infectious pharyngoesophagitis. However, endoscopy allows for biopsy and culture to further direct management.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® [Radiation Dose Assessment Introduction](#) document.

Relative Radiation Level Designations		
Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
○	0 mSv	0 mSv
⊗	<0.1 mSv	<0.03 mSv
⊗ ⊗	0.1-1 mSv	0.03-0.3 mSv
⊗ ⊗ ⊗	1-10 mSv	0.3-3 mSv
⊗ ⊗ ⊗ ⊗	10-30 mSv	3-10 mSv
⊗ ⊗ ⊗ ⊗ ⊗	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as “Varies”.

Supporting Documents

For additional information on the Appropriateness Criteria methodology and other supporting documents go to www.acr.org/ac.

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The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.