EDITORIAL

Esophageal Disorders and Scintigraphy: One Clinician's Perspective

The evaluation of disorders of the esophagus starts with an assessment of the patient's symptoms, including aspiration and nasal regurgitation, dysphagia and food impactions and pain or burning in the chest. The clinician's task is to tease out distinctive symptoms to classify the patient's problem into one of three major categories: (1) *oropharyngeal dysphagia*, (2) *esophageal dysphagia*, or (3) *noncardiac chest pain*. This categorization facilitates the clinician's decision-making regarding the priority of tests to be obtained to clarify the diagnosis.

Patients who have oropharyngeal dysphagia typically admit to choking or aspirating foods or liquids, complain of nasal regurgitation, may have more difficulty swallowing liquids than solids, and often cannot initiate the swallowing of particulate solids such as rice or potato chips. These patients may also carry neurological diagnoses, such as history of a stroke, Parkinson's disease or neuromuscular disorders involving striated muscle. By taking a careful history, patients with oropharyngeal dysphagia can generally be adequately distinguished from those who more likely suffer from esophageal dysphagia. Esophageal dysphagia patients do not typically choke on their food, but, rather, have the sensation that boluses of food or liquid do not pass properly into the stomach. The boluses seem to progress too slowly through the esophagus, or even impact in the chest area. These patients may also have regurgitation of undigested food, which often does not have a sour or bitter taste, as though the food has not reached the stomach. This may or may not be accompanied by a degree of pain or pressure in the chest. Finally, there are patients whose primary complaint is that of chest pain. Their main symptom is that of pressure, pain or burning in the chest, which may or may not have an associated sense of food sticking on an intermittent, unpredictable basis. Once the clinician has classified the patient's symptom complex, the next step is testing to confirm the suspicion and target a final diagnosis.

OROPHARYNGEAL DYSPHAGIA

Oropharyngeal dysphagia is traditionally documented by a *modified barium swallow* performed by a specialized swallowing therapist. The patient is asked to swallow thin or thickened barium, or even barium-coated soft solids, while video fluoroscopy is performed. This provides an assessment of the muscular function and coordination of the tongue and mouth, as well as proximal pharynx. A patient's symptoms, such as aspiration, nasal regurgitation or gurgling sounds, can often be correlated with the specific muscles or structures that are dysfunctional in the oropharyngeal region. Gaining such specific information enables the therapist to train the patient to overcome his or her disabilities (*1*).

Manofluorography is now available in certain centers. This technique combines a modified barium swallow with manometric records obtained using solid-state catheters to document coordination of contractions in the upper pharynx. Traditional manometry may also play a role in certain cases when the question of cricopharyngeal achalasia is raised as the etiology of oropharyngeal dysphagia or repeated aspiration (*2*).

Traditionally, scintigraphy has not been in widespread use for the evaluation of oropharyngeal dysphagia. There have been reports, however, of utilizing scintigraphy to recognize and, to a degree, quantify subglottic aspiration (*3,4*). To date, this technique has not been used extensively outside of research centers. It could potentially find a clinical role, however, in certain situations, such as helping to clarify whether or not a particular patient's recurrent pneumonias are actually due to aspiration.

ESOPHAGEAL DYSPHAGIA

The evaluation of true esophageal dysphagia generally begins with a traditional barium swallow in order to rule out anatomical etiologies, such as strictures, tumors or webs, versus functional disorders, such as achalasia, scleroderma or diffuse esophageal spasm. In those patients for whom an anatomic etiology is suggested, as well as those for whom achalasia is suggested, an *upper endoscopy* is performed to rule out tumor and to proceed to dilatation when appropriate in the cases of strictures and webs. For those patients who have a barium swallow more suggestive of a motility disorder, generally a manometry is obtained to confirm the diagnosis prior to initiating therapy. Although scintigraphy could potentially be utilized as further confirmation of a particular motility disorder, *most esophageal motility disorders are presently defined by their manometric findings.*

Currently, manometry provides the most accurate measurements of the strength of contractions as well as the timing and coordination of the peristaltic waves down the esophagus. Specific criteria have been set in terms of the amplitudes, durations and timing of contractions in the body of the esophagus, as well as normal ranges

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for the resting tone and percent relaxation and timing of relaxation of the upper and lower esophageal sphincters. It is these measurements that are used to define various esophageal motility disorders (*5*). Most patients receive manometry to confirm their diagnosis prior to undergoing invasive treatment such as surgery or balloon dilatation for achalasia. Manometry is also frequently used to document normal peristalsis in the esophageal body before referring a patient for a surgical anti-reflux procedure.

Scintigraphy could potentially play a major role in the diagnosis of motility disorders if the findings could be reliably correlated with the pressure tracings obtained by manometry. There are patients who cannot or will not swallow a motility catheter, but who may be able to withstand esophageal scintigraphy. Scintigraphy could also be used as another means of assessing motility in patients who have a normal or nondiagnostic esophageal motility study. Some small-scale studies have been published correlating scintigraphic findings with manometric tracings (*6*), but more extensive research is needed for confirmation.

Scintigraphy offers the most accurate assessment of esophageal function in terms of documenting the actual progression of a bolus of food or liquid through the esophagus and quantitating the percent emptying in a fixed period of time. Scintigraphy, therefore, could also serve to provide an objective measure of progression of disease or improvement on therapy for patients with esophageal dysphagia. More frequently, clinicians make the diagnosis of a specific motility disorder using manometry and then assume that the patient's symptoms are secondary to the manometric abnormalities. In many or most cases, this is probably a fair judgment; however, there may be more unusual cases in which scintigraphy could provide a more accurate correlation between manometric abnormalities and true esophageal function. Scintigraphy also could provide an important research tool in the development of pro-motility agents for the esophagus and confirming their usefulness in vivo.

NONCARDIAC CHEST PAIN

Patients who suffer from substernal chest pain or pressure, often with radiation to the back or left arm, are initially evaluated for cardiac etiologies. Most will proceed to at least a thallium stress test, if not cardiac catheterization, in order to rule out coronary artery disease. In those who have no apparent cardiac etiology, an esophageal source is typically sought, with a particular interest in ruling out diffuse esophageal spasm, nutcracker esophagus or gastroesophageal reflux. Again, manometry is useful in diagnosing diffuse esophageal spasm or nutcracker esophagus. In addition, it can provide a measurement of lower esophageal sphincter function. Twenty-four-hour ambulatory manometry devices are also currently in use in some centers in the United States. For patients in whom gastroesophageal reflux is in question, a Bernstein acid perfusion test can also be performed through the manometry catheter (*7*).

If gastroesophageal reflux remains an uncertain diagnosis, some patients are given a 24-hr pH probe study, which documents the number and duration of acid reflux episodes in a 24-hr period (*8*). Esophageal scintigraphy also has been used to evaluate the frequency of gastroesophageal reflux and clearance of refluxate from the esophagus (*9*). A shortcoming of this method, however, is that it evaluates the patient over a very limited period of time in an artificial setting. A pH probe study, however, permits the patient to continue with his or her usual activities of daily living, including eating and sleeping. This is particularly useful in patients who primarily reflux only post-prandially or nocturnally. There is always the question of whether or not the presence of a pH probe in the distal esophagus alters the patient's normal physiology, but the test thus far has been very successful in the clinical setting (*10*).

CONCLUSION

In summary, esophageal scintigraphy currently offers the most precise assessment of function in the esophagus. Thus, it can be utilized to confirm a patient's subjective sensation of dysphagia. It also can be used to correlate manometric findings with actual esophageal function both in the clinical and in experimental settings. This has particular potential in pharmaceutical research and development. Technically, for many patients, esophageal scintigraphy provides a more acceptable approach to assessing esophageal function and may provide a second means for diagnosing motility disorders in patients with normal or equivocal manometries.

The use of esophageal scintigraphy would probably increase in many centers if there were more studies correlating scintigraphic findings with those of simultaneous manometric tracings. Standards could then be set in order to diagnose esophageal motility disorders by scintigraphy alone. The clinician needs the reassurance that scintigraphic findings can indeed be *diagnostic* for motility disorders, so that manometry is not necessary to confirm the diagnosis. The diagnosis and treatment of esophageal motility disorders is still a young and rapidly evolving field, with plenty of room for the contributions of scintigraphy.

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SELF-STUDY TEST

Pulmonary Nuclear Medicine

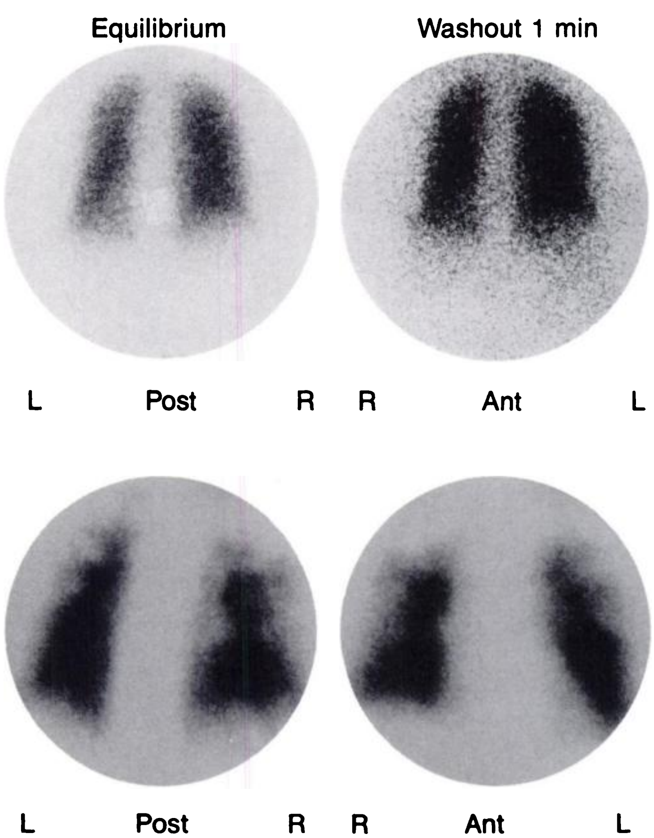
Questions are taken from the *Nuclear Medicine Self-Study Program I*, published by The Society of Nuclear Medicine

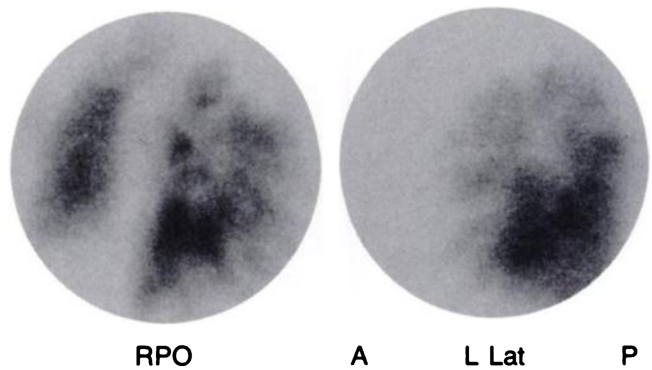
DIRECTIONS

The following items consist of a heading followed by numbered options related to that heading. Select those options you think are true and those that you think are false. Answers may be found on page xxxx.

Figure 1 shows the ventilation-perfusion images in a 54-yr-old woman with suspected pulmonary embolism. True statements concerning this clinical situation include:

1. The findings are consistent with pulmonary lymphangitic carcinomatosis.
2. The changes, if due to pulmonary lymphangitic carcinomatosis, would be primarily caused by spread of tumor through the lymphatic system of the lungs.
3. A normal chest radiograph would be very unusual in a patient with these findings on perfusion imaging.
4. Diffuse vasculitis occasionally produces similar findings.





True statements concerning pulmonary ventilation and perfusion include:

5. Patient position is an important determinant of regional ventilation because of gravitational effects on intrapleural pressure gradients.
6. In the upright patient, airflow is greatest in alveoli at the apex.
7. Both ventilation and perfusion increase from apex to base in the upright lung, but the ventilation-perfusion ratio decreases.
8. Xenon gas clears most quickly from regions of lung having high alveolar compliance.
9. Gas exchange is best in regions where perfusion is less than ventilation.

True statements concerning pathologic conditions affecting pulmonary function include:

10. Pneumoconstriction following pulmonary embolization is rarely observed in xenon ventilation studies.
11. Pulmonary infarction frequently occurs (over 40% of cases) as a result of pulmonary embolism.
12. Alveolar hypoxia is often associated with obstructive pulmonary disease.
13. Precapillary arteriolar sphincters normally respond to alveolar hypoxia by dilating.
14. Airways collapsing from loss of normal alveolar structure is a hallmark of both obstructive and restrictive lung disease.

(continued on page 1336)