

Pulmonary Aspiration as a Consequence of Gastroesophageal Reflux

A Diagnostic Approach

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A radioisotope scintiscanning technique that can document pulmonary aspiration of gastric contents in patients with gastroesophageal reflux is described. Six patients with suspected nocturnal aspiration from reflux were studied. Three of the six had positive lung scans 8 hr after intragastric placement of 10 mCi of technetium 99m sulfur colloid. Overnight intraesophageal pH monitoring revealed prolonged episodes of GE reflux in those with positive scans. These preliminary observations suggest that this scintigraphic technique may be an effective method for documenting pulmonary symptoms as a consequence of gastroesophageal reflux.

An association between gastroesophageal (GE) reflux and pulmonary disease has been postulated, although documentation of this relationship is lacking (1). Symptoms suggestive of aspiration, such as nocturnal cough, have been reported to occur in 10-50% of patients with GE reflux (2). In addition, the possibility that asthma may result from chronic nocturnal aspiration of refluxed gastric contents has been proposed (3). Objective tests are needed to confirm the clinical impression of aspiration as a consequence of GE reflux.

Our interest in this area stems from frequent clinical encounters with reflux patients who complain of nocturnal cough or have evidence of pulmonary dis-

ease. A patient with aspiration pneumonitis, presumed secondary to GE reflux, provided the opportunity for us to initiate work in this area. Our findings relative to this and several other patients form the basis of this report.

CASE REPORT

A 51-year-old man was admitted to the National Naval Medical Center because of fever, emesis, and nocturnal coughing. He had undergone vagotomy and antrectomy with Billroth II anastomosis two months prior to admission, for treatment of peptic ulcer disease. His post-operative recovery was complicated by a nocturnal cough which would awaken him from sleep. The patient had smoked one pack of cigarettes daily for many years, but ingested alcohol only on rare occasions. Admission physical examination revealed an ill-appearing white male with a temperature of 39.6°C. Rhonchi and rales were heard over the left lower lung field.

A chest roentgenogram showed a left lower lobe infiltrate (Figure 1a and b). Room air arterial blood gas determination revealed a pH of 7.52, PO₂ of 64 mm Hg and a PCO₂ = 30 mm Hg. The white blood cell count was 15,000/mm³ with a "shift to the left" noted on the peripheral blood smear. Cultures of sputum grew common oral flora; no acid-fast bacilli or fungal organisms were isolated. A barium meal showed GE reflux and a partial gastric outlet obstruction resulting from a jejuno gastric in-

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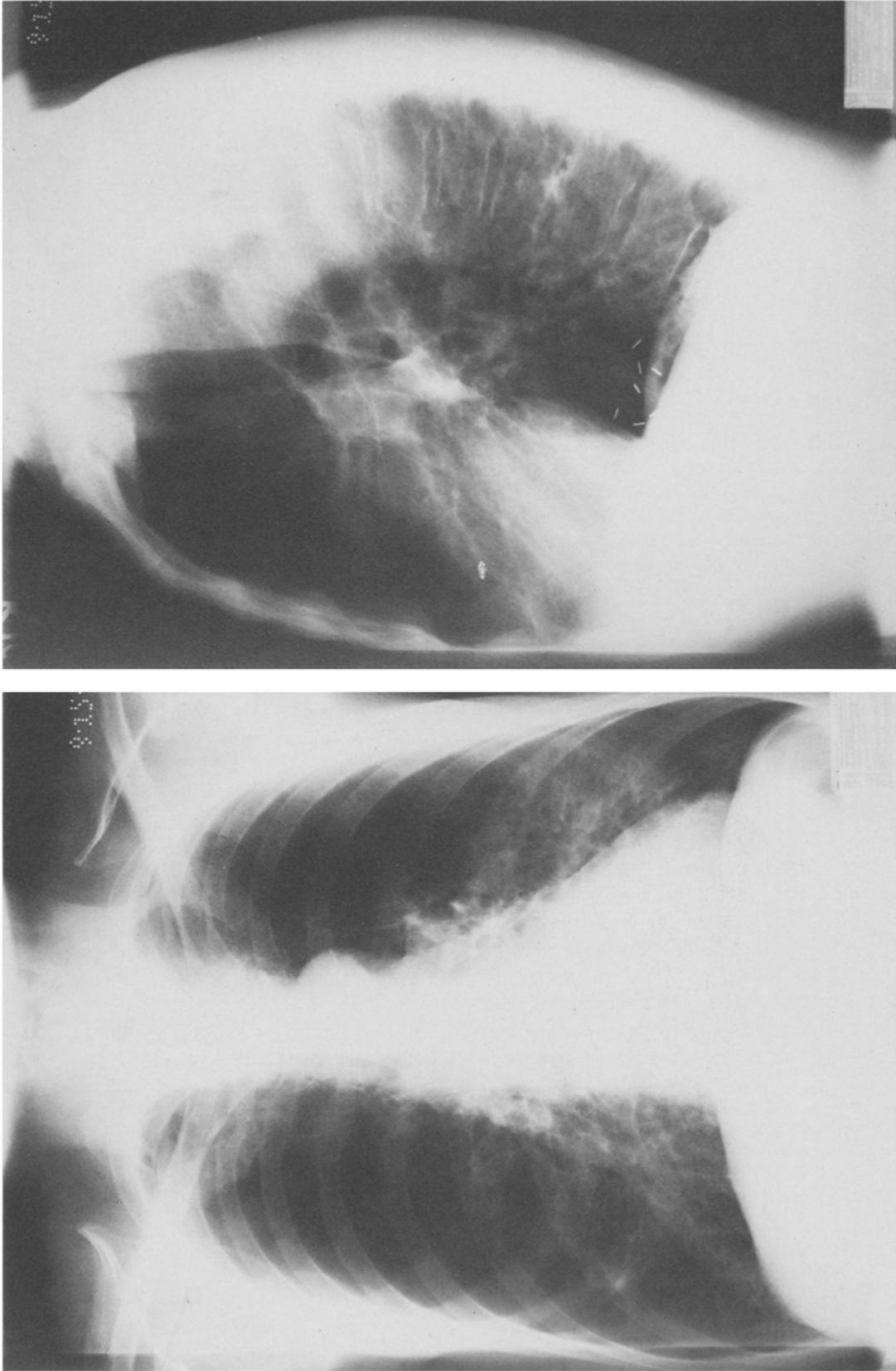


Fig 1. Postero-anterior (a, left) and lateral (b) chest roentgenograms, demonstrating an area of infiltrate in the left lower lung field.



Fig 2. Scintigraphic study with 3 views revealing isotopic uptake in the left lung field. Radioactive marker is noted over the xiphoid process and intense radioactive uptake is seen in the gastric pool.

tussusception. Esophageal manometry showed a lower esophageal sphincter (LES) pressure of only 3 mm Hg, consistent with lower esophageal sphincter incompetence (4).

Aspiration of refluxed gastric contents was suspected. To confirm our clinical impression a GE scintiscan study, modified after Fisher (5), was performed (see Materials and Methods). The scan obtained demonstrated isotopic uptake in the area of pulmonary infiltrate (Figure 2). The possibility of nonspecific, hematogenous spread of isotope to an area of inflammation (such as pneumonia) was excluded by obtaining a negative scan after intravenous injection of pertechnetate and technetium sulfur colloid.

The patient's pneumonia was treated with penicillin and soon resolved. The jejuno gastric intussusception was treated surgically, and at the time an antireflux procedure was performed (Nisson fundoplication). The patient's nocturnal cough abated, and he has experienced no further episodes of pneumonia.

MATERIALS AND METHODS

Study Population. Five additional male patients (age range 35-60 years) were studied. These were patients re-

ferred to us for evaluation of respiratory symptoms thought secondary to chronic aspiration of refluxed gastric contents. In addition, three normal males without respiratory or esophageal symptoms gave informed consent to serve as controls for the scintigraphic technique (see below).

Scintigraphic Technique. The six patients (index plus five study subjects) were fasted after supper (6 PM). At bedtime (11:30 PM) a nasogastric tube (Salem Sump, 14 French) was introduced through the nose, into the stomach, with the patient in the upright position. Thirty milliliters of water were swallowed to facilitate passage of the tube. Ten millicuries of technetium 99m sulfur colloid were then instilled into the stomach via the tube and the latter was then flushed with an additional 30 ml of water. Therefore, a total of 70 ml of fluid were used to dilute the isotope. The nasogastric tube was removed and the patient kept upright for an additional 15 min. Patients were then placed recumbent with the head of the bed flat and permitted to sleep until 7 AM when they were taken to the Nuclear Medicine Division for lung scanning.

Anterior and posterior views of the chest were obtained using a gamma camera (Searle HP) and low-energy hole collimator. A transmission scan was obtained first, to aid

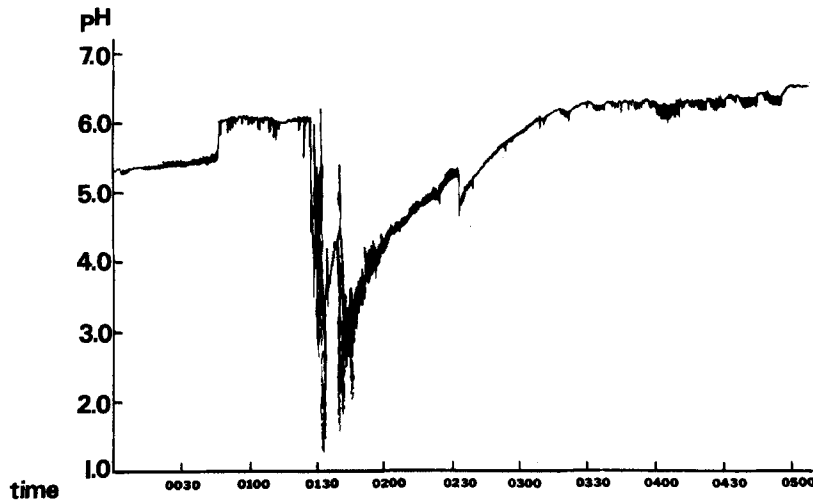


Fig 3. Representative overnight intraesophageal pH recording in patient with gastroesophageal reflux and aspiration. Note prolonged period with pH below 4.0

in positioning the gamma camera and to identify the location of the lungs and heart. Radioactive markers were placed over the xiphoid process and suprasternal notch to further aid anatomical localization. The pulmonary scan was considered positive if any activity above background was found in any lung field.

To determine if false-positive scintigraphs would occur as a result of nasogastric tube removal (for example, by the tube carrying isotope from the stomach to the pharynx) we scanned 3 normal volunteers, 30 min after removal of the tube as outlined above.

Esophageal Manometry. Lower esophageal sphincters (LES) were localized, and pressures were measured, using a water-perfused manometric assembly as previously described (6, 7).

Intraesophageal pH Monitoring. In the 5 study patients a Beckman pH probe was inserted via the nose and positioned 5 cm above the superior margin of the manometrically determined LES as previously described (8). A Beckman reference lead was placed on the arm and both leads were connected to a pH meter that recorded pH continuously on a strip chart recorder running at 6 in./hr. The entire assembly was housed on a movable cart and standardized with known pH solutions prior to use at the patient's bedside. Acid reflux was considered to occur whenever the pH in the lower esophagus decreased to less than 4 for greater than 30 min. After the pH monitoring probe was passed and functioning, a nasogastric tube was passed through the opposite nostril for isotope instillation as described above. The pH monitoring equipment was started when the patient retired at 11:30 PM and discontinued at 7 AM the following morning.

RESULTS

Two of the five study patients had an abnormal scintiscan, similar to that of the index case (Figure

2), and prolonged episodes of acid GE reflux on the overnight intraesophageal pH tracing (Figure 3). The other three study patients as well as the three normal volunteers showed no isotope uptake above the gastric pool (Figure 4), and the former group had either physiologic reflux that was rapidly cleared from the esophagus or no acid reflux on overnight pH study. All five patients referred for study were found to have a hypotensive LES (10 mm Hg). The three normal volunteers had LES pressures of 15, 18, and 22 mm Hg, respectively.

DISCUSSION

Although nocturnal GE reflux may be diagnosed by intraesophageal pH monitoring (8-10), a test to document pulmonary aspiration as a consequence of reflux has been needed. Based on the findings reported here and elsewhere (11), we speculate that a number of patients with GE reflux aspirate chronically, resulting in pulmonary symptoms. The scintigraphic test described appears to be a means to objectively define this entity.

The case described had features frequently seen in the reflux patient who aspirates, including a nocturnal cough that would awaken him from sleep and a pneumonitis in a location typical for nocturnal pulmonary aspiration. He had a potentially poor barrier against reflux while sleeping, with a LES pressure of only 3 mm Hg. Additionally, the gastric outlet obstruction from the intussusception would be expected to further aggravate reflux (12). We



Fig 4. Scintigraphic study in subject without aspiration. Markers are seen over manubrium and xiphoid process. The only isotopic activity seen is in the gastric pool.

were pleased that the pulmonary scintiscan supported our clinical impression by showing isotope uptake in the area of pneumonitis. The possibility that gastrointestinal absorption of the isotope allowed for nonspecific hematogenous spread of isotope to an area of inflammation (such as a pneumonitis) was considered. This was excluded by obtaining a negative scan after intravenous injection of pertechnetate and technetium sulfur colloid.

Prior to use as a diagnostic test for aspiration from reflux, the pulmonary scintiscan must first be compared to a previously established test that measures nocturnal GE reflux. Overnight intraesophageal pH monitoring distinguishes symptomatic reflux patients with prolonged reflux episodes, due to persistent reflux and/or poor esophageal clearing, from asymptomatic control volunteers with either no reflux at night or, if episodes occur, rapid clearance (8, 9). If both the pulmonary scintiscan and intraesophageal pH monitoring were simultaneous-

ly performed in the same patient, one would expect patients with scintiscans indicative of pulmonary aspiration to have prolonged reflux episodes on the overnight pH record. In contrast, those with normal overnight pH records should have no evidence of aspiration on scan. This indeed was the case in our pilot study of five patients.

It is unlikely that any abnormal scintiscans resulted from pulmonary aspiration of pharyngeal secretions contaminated by isotope. This was an important consideration to us since Huxley et al (13) reported that aspiration of pharyngeal secretions occurs in 45% of normal subjects during sleep. To prevent this, rather than having the patient swallow the isotope, we chose to instill the technetium directly into the stomach via a nasogastric tube, thus bypassing the pharynx. To assess whether removal of the NG tube (after gastric instillation of isotope) contaminated the pharynx, we scanned three normal volunteers 30 min after NG tube removal. No

radioisotopic uptake was seen above the gastric pool. The persistent dense radioactivity seen in the gastric pool greater than 7 hr after administration of the isotope (Figures 2 and 4) is of interest. This is a constant finding which may represent the active concentration of technetium by the gastric parietal cells, a phenomenon frequently used to detect the presence of ectopic gastric mucosa in a Meckel's diverticulum (14). However, the animal data of Berquist et al (15) suggest that the isotope may be taken up by the stomach's superficial epithelial cells.

Future investigations might consider concentration of technetium by salivary glands. If such were the case, aspiration of salivary contents might lead to false-positive scintiscans. The cause of pulmonary symptoms such as wheezing and nocturnal cough is often unclear and difficult to attribute to GE reflux. Cigarette smoking may result in both cough secondary to bronchial irritation and cough as a result of reflux, since smoking lowers LES pressure (16). Although cough may result as a consequence of GE reflux, coughing itself may induce reflux (6, 17). For these reasons, symptoms alone are unreliable indications of aspiration as a consequence of reflux.

Objective evidence of aspiration from GE reflux as the etiology of pulmonary disease would offer the clinician an approach to therapy directed at the cause of the disorder. This was exemplified in our case report where our patient's nocturnal cough abated after surgery. Our data suggest that the pulmonary scintigraphic test can provide the objective evidence necessary to define the etiology of pulmonary symptoms in the reflux patient with lung disease. Further investigation with the pulmonary scan may lead to modifications in technique such as the use of a technetium filled capsule at bedtime. This would alleviate the need for NG tube, manometry, and pH probes. Such a capsule would allow the test to become a noninvasive outpatient test.

In summary, a technique is described that may prove helpful in the diagnosis of pulmonary aspiration as a consequence of GE reflux. This complication of reflux is often not recognized because of a relative lack of appreciation of its occurrence and the absence of specific methods of testing. Our preliminary data suggest that the scintigraphic test may

be effective in identifying those reflux patients who suffer nocturnal pulmonary aspiration.

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