Computed Tomography in Patients with Esophageal Perforation*


Contrast esophagram is the diagnostic procedure of choice in patients with clinically suspected perforation of the esophagus. In patients in whom the usual clinical signs or symptoms are unrecognized and in whom the diagnosis is obscure, the diagnosis of a perforated esophagus may be suggested by the finding of mediastinal fluid and air on CT. Three patients are reviewed. The perforations included one spontaneous, one from erosion of an esophageal carcinoma, and one iatrogenic. In two of the three patients, the diagnosis of perforated esophagus had not been made initially and in one patient the initial esophagram was interpreted as normal. Computed tomography of the chest in each patient led to the suspected diagnosis of perforated esophagus. Prompt appropriate surgical intervention followed. The findings of mediastinal fluid and more importantly mediastinal air on CT of the chest are strongly suggestive of esophageal perforation.

(Chest 1990; 98:1078-80)

CT = computed tomography

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epite the usually typical acute symptoms of esophageal perforation, the diagnosis of this catastrophic event frequently is missed by the initial physicians caring for the patient owing to a lack of familiarity with this problem. Even in patients with instrumental perforation, the diagnosis often is delayed.

Patients with spontaneous perforation who present with Mackler's1 classic triad of vomiting followed by lower thoracic pain and subcutaneous emphysema may quickly be suspected of having a perforated esophagus and the diagnosis confirmed by contrast esophagram. Many patients, however, present with less specific symptoms such as severe respiratory distress, hypotension, sepsis, shock, coma or only vague evidence of an acute abdominal or thoracic emergency. In a recent 30-year review by Pate and associates,2 physical examination was of aid in the diagnosis of perforated esophagus in nine of 34 patients, and the initial chest roentgenogram "compatible with perforation of the esophagus" in only 27 percent of patients. In many of these patients in whom the diagnosis is unrecognized, the battery of diagnostic procedures frequently will include CT of the chest, abdomen or both.

Appraisal of the CT examination for signs suggestive of perforated esophagus as described by Faling et al3 and Ben-Ami et al4 may direct the clinician with some degree of certainty to the diagnosis. The recognition of mediastinal air adjacent to the esophagus is most important.

Three reports of patients with a perforated esophagus in which the initial diagnosis was first suggested or confirmed by CT are presented. In two patients, esophageal contrast studies were obtained after a CT scan suggested the diagnosis. In both, the esophagram confirmed the diagnosis. In the third patient, an initial esophagram was interpreted as normal, but the CT findings supported the diagnosis of esophageal perforation and appropriate exploration and treatment were carried out as the result of this examination.

CASE REPORTS

CASE 1
A 74-year-old man complained of epigastric and upper mid-back pain after mild exertion. He had a history of coronary artery bypass graft four months prior to the present episode. A 6-cm abdominal aortic aneurysm also was known to be present. No history of emesis was obtained. On admission to a community hospital, he was afebrile and had a pulse rate of 88 and blood pressure of 220/120 mm Hg. On examination he had diffuse upper abdominal tenderness and a prominent abdominal aortic aneurysm. A roentgenogram of the chest was reported as normal.

He was transferred to Northwestern Memorial Hospital for CT of the upper abdomen and lower thorax to confirm a suspected contained rupture of the abdominal aortic aneurysm. Computed tomography demonstrated no change in the size of the abdominal aortic aneurysm and no evidence of aortic dissection or hematoma. However, the scan did demonstrate air in the soft tissues of the mediastinum surrounding the esophagus and a small left pleural effusion which was not visible on the anteroposterior roentgenogram of the chest (Fig 1). The thoracic surgical service was consulted and a contrast esophagram confirmed the diagnosis of perforated esophagus. The patient had primary repair of the esophageal perforation with pleural flap reinforcement of the esophageal closure. His postoperative course was uneventful and he was discharged from the hospital after a normal esophagram had been obtained.
CASE 2

A 62-year-old woman was admitted to the medical service with a six-month history of anorexia, malaise and an 11-pound weight loss. She also had a four-month history of hoarseness and productive cough. There was no history of dysphagia. She smoked one pack of cigarettes and drank two to three ounces of alcohol per day. Twenty years previously she had been exposed to tuberculosis and had received isoniazid for six months. A roentgenogram of the chest demonstrated a superior posterior mediastinal mass thought to be consistent with Potti's disease of the spine. There was no pleural effusion or mediastinal emphysema noted. Spinal tomography demonstrated erosion of the fourth thoracic vertebra. A CT of the spine obtained by the orthopedic service showed air in the mediastinal soft tissue surrounding the esophagus, abscess cavities in each pleural space adjacent to the esophagus, and erosion of the thoracic spine (Fig 2). The diagnosis of a perforated esophagus was confirmed by contrast esophagram. At esophagoscope, a perforated esophagus secondary to squamous cell carcinoma was identified. A right axillary thorotomy was performed to drain the mediastinal abscesses. The patient died suddenly of a massive hemorrhage from suspected erosion of the tumor into the aorta on the 14th postoperative day.

CASE 3

A 27-year-old man developed quadriplegia due to a spinal cord injury at the level of C4 following a motor vehicle accident and was admitted to the spinal cord intensive care unit. The patient required urgent airway intubation because of respiratory distress. Roentgenograms of the chest revealed a minimally widened superior mediastinum. On the fourth day after the accident the patient became febrile and a repeat roentgenogram of the chest showed mediastinal air but no pleural effusion. A Gastrografin esophagram was obtained which was normal. Computed tomography was obtained. This demonstrated air in the mediastinal soft tissue adjacent to the esophagus along with small air fluid levels (Fig 3). An esophagram was repeated but again was normal. However, because of the CT findings, a left anterior cervical mediastinotomy was performed. Foul purulent material was drained from the visceral compartment. Subsequent fiberoptic esophagoscopy revealed an esophageal perforation which apparently had occurred at the time of intubation. The patient did well with the cervical drainage, the infection subsided and the esophageal leak healed without further intervention.

DISCUSSION

Ideally, the diagnosis of perforated esophagus should be suspected by the clinician after a thorough history and complete physical examination. Once the diagnosis of perforated esophagus is suspected, the initial diagnostic step is a standard roentgenogram of the chest. The typical roentgenographic signs of possible perforated thoracic esophagus are mediastinal air, pleural effusion or hydro pneumothorax and subcutaneous emphysema. If pleural fluid is removed for analysis, evidence of a perforated esophagus is suggested by a pH value less than 6.0 or elevated amylase. Payne et al5 suggested that with any of these findings present, the next examination should be contrast esophagram to confirm the diagnosis. However, when the roentgenographic features are not identified or are misinterpreted, the contrast esophagram may not be performed. Even when done, as noted by Bladergroen et al,6 the contrast study may be negative in up to 10 percent of instances, especially when Gastrografin is used as the contrast material.

Computed tomography often is obtained in critically

FIGURE 1. Patient 1. Boerhaave's syndrome in a patient with a known abdominal aortic aneurysm. A contrast-enhanced CT image through the lower thorax reveals air and low-density fluid around the esophagus (containing a nasogastric tube) and throughout the posterior mediastinum. Also noted is a left pleural effusion that was not detected on plain radiographs.

FIGURE 2. A noncontrast-enhanced CT scan (obtained with the patient in the prone position) through the upper thorax reveals air dissected throughout the posterior mediastinal mass with erosion of the vertebral body.

FIGURE 3. Patient 3. Esophageal perforation from intubation of the airway. A contrast-enhanced CT scan through the mediastinum reveals air and some air-fluid levels in the soft tissues adjacent to the esophagus.
ill patients with obscure thoracic or upper abdominal complaints. It is in this situation that a CT of the chest, when properly interpreted, may be an effective diagnostic tool.

Two of the three patients described here had atypical symptoms for esophageal perforation and the diagnosis was not initially suspected. In the third patient a negative contrast study of the esophagus presumably ruled out an esophageal perforation. In all three, the diagnosis was strongly suggested after review of the CT scan of the chest which revealed fluid and air in the mediastinal space adjacent to the esophagus.

The diagnosis of perforated esophagus should be entertained if the scan demonstrates: (1) air in the soft tissues of the mediastinum surrounding the esophagus, (2) abscess cavities adjacent to the esophagus in either the pleural space or mediastinum or (3) actual communication of an air-filled esophagus with an adjacent mediastinal or paramediastinal air-fluid collection. Evidence for esophageal perforation is strengthened by the presence of a pleural effusion, most often on the left side. When any of these CT signs are present, a contrast esophagram should be obtained immediately to confirm the diagnosis and to locate the perforation prior to standard emergent surgical treatment. We reemphasize that in 10 percent or more of these patients the esophagram will be “normal.” In these cases the diagnosis must be based solely on the history and physical and may be supplemented by the findings on the CT examination.

REFERENCES
1 Mackler SA. Spontaneous rupture of the esophagus. Surg Gynecol Obstet 1952; 95:344-56

8th Congress, International Society for Aerosols in Medicine

The 8th Congress of ISAM will be held in Davos, Switzerland, April 14-17. Prof. Dr. H. Matthys has announced the deadline for abstracts is December 1, 1990. For information, contact ISAM Congress Tourist Office, Convention Department, Promenade 67, Davos, Switzerland (0041) 81 435 135 (Fax: 0041 81 431 410).