

Timely diagnosis of esophageal perforation

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The Case

A man with mixed connective tissue disease on low-dose prednisone and methotrexate presented moribund with chest and left shoulder pain, a left hydropneumothorax, and progressive respiratory failure. The initial diagnosis was community-acquired pneumonia (CAP) and treatment included ceftriaxone, azithromycin, and stress-dose hydrocortisone. Over the ensuing days, the patient's condition deteriorated with worsening respiratory failure, progressive encephalopathy, and septic shock requiring vasopressor medications. Antibiotics were changed to vancomycin, levofloxacin, and—due to the presence of hyphae on thoracentesis—anidulafungin. Blood and sputum cultures were negative, and pleural fluid cultures grew *Candida albicans*. Based on a diagnosis of fungal empyema, the patient underwent a left thoracotomy with decortication on hospital day 11. Postoperatively, a new right pleural effusion developed, and fluid from a second thoracentesis grew *Candida albicans*, *Candida lusitanae*, *Lactobacillus*, and alpha-hemolytic *Streptococcus*. Antibiotic and antifungal medications were continued. On hospital day 26, the radiologist described an evolving mediastinal process with gas suggestive of an esophageal perforation. A Gastrografin (diatrizoate meglumine/datrizoate sodium) esophagram demonstrated a small outpouching of the distal esophagus, and a computed tomography esophagram confirmed extravasation of contrast into bilateral pleural spaces. The patient underwent an urgent right thoracotomy with mediastinal debridement and wide drainage.

The Commentary

Commentary by Garth H. Utter, MD, MSc and David T. Cooke, MD

Esophageal perforation is usually not a subtle diagnosis to make, assuming the possibility is entertained. However, the rarity of this condition, especially if it involves a subacute presentation—as likely occurred in the above case, with immunosuppression a contributing factor—can confuse matters. The most common reasons for esophageal perforation include instrumentation (namely, esophagogastroduodenoscopy [EGD]), vomiting/retching (Boerhaave syndrome), and foreign body

ingestion, so usually there are features of the patient's history that point towards this diagnosis. In the absence of such historical characteristics, physicians should strongly consider the diagnosis in any systemically ill patient who has an unexplained hydropneumothorax or mediastinal gas. Given the rarity of spontaneous fungal empyema, the index of suspicion for an esophageal source should have increased substantially with the finding of fungal contamination of the pleural space. Except among the most profoundly immunosuppressed patients, fungus is a rare cause of pneumonia (and thus implausible as a cause of "parapneumonic empyema"), but, probably in part because gastric acid secretion strongly suppresses bacterial load, it is commonly identified after perforation of the upper gastrointestinal tract. Even in confusing circumstances, telling details revealed by persistent information-gathering—such as the appearance of the pleural fluid—frequently help point physicians to the correct diagnosis.

Timely diagnosis of esophageal perforation is critical because recognition within 24 hours has been associated with a nearly 50% reduction in mortality (14% vs. 27%).¹ Thin barium esophagography is the criterion standard diagnostic test. Water-soluble Gastrografin should be used with considerable care, as it is hypertonic and can cause aspiration pneumonitis, and thin barium has greater sensitivity for identifying perforation. Despite concerns expressed by some authors, barium-induced mediastinitis is rare.² Esophagography in a moribund patient may be challenging, but it can be accomplished by backing the nasogastric tube into the proximal esophagus under fluoroscopic guidance, then instilling the contrast agent. Although EGD is a less sensitive test than esophagography (especially for small lesions), intraoperative EGD at the time of the initial decortication probably would have had a sensitivity comparable to that of esophagography.

Initial management of esophageal perforation focuses on drainage (nasogastric and pleural space), fluid resuscitation, and early antibiotics, some or all of which occurred in this case even without the correct diagnosis. However, control of the source of sepsis is critical, and the physicians—including the surgeon who performed the left thoracotomy and decortication—erred by failing to imagine an alternative diagnosis besides pneumonia (anchoring, or premature closure). This failure occurred despite several clues suggesting gastrointestinal tract perforation and a prolonged treatment course during which the patient made little if any progress.

Misdiagnosis and Cognitive Error

A recent study of malpractice claims suggests that infections, and particularly those resulting in sepsis, represent one of the three most common causes of serious harm from misdiagnosis.³ Diagnostic error remains an important but relatively poorly understood and measured topic in patient safety. While recent interest has focused on improving communication and teamwork, clinical decision support, and follow-up of diagnostic tests as means to reduce diagnostic errors,⁴ this case seems to concern more squarely the role of physician cognition. We can only speculate on the variety of cognitive shortcuts that may have contributed in this case: Had the physicians ever cared for a patient with an esophageal perforation before, or had they recently treated some patients with complicated pneumonia (availability bias)? Were the physicians unduly swayed by the fact that de novo respiratory complications such as pneumonia and pneumonitis are fairly common in patients with mixed connective tissue disease (framing)? Did the intensive care physicians assume that the surgeon who performed the initial decortication must have considered the possibility of an esophageal perforation (blind obedience)?

How to Address Cognitive Errors

Although the cognitive biases that lead to misdiagnosis take many forms, many experts agree that effective diagnosticians are good at “iterative hypothesis testing”: periodic re-evaluation of the available information to refine the list of possible diagnoses.⁵ Systematic pressures in modern inpatient care may detract from using iterative hypothesis testing, including such factors as electronic health record-generated problem lists, less in-person interaction among providers due to technological advances (electronic records, picture archiving and communication systems), concerted emphasis on other aspects of safety besides correct diagnosis (e.g., sepsis bundles, or prophylaxis against venous thromboembolism), shift-based care, a de-emphasis on gathering information directly from the patient, and inadequate time and reimbursement for cognitive work. Mindful recognition of how physicians think and the ways in which their thinking fails (metacognition) may offer one of the best strategies for reducing cognitive diagnostic errors.⁶

Potential System Interventions

Diagnostic errors in complex patients with a multidisciplinary provider team may warrant strategies specifically to promote slower “analytic” thought over quicker “intuitive” thinking.⁷ For example, daily multidisciplinary ICU rounds is a well-accepted strategy to improve patient safety generally,⁸ but dedicated time for a weekly “challenging case” multidisciplinary conference might have prompted the patient’s intensivist(s), radiologist(s), surgeon, or nurses to raise any inconsistencies or latent doubts about the diagnosis of pneumonia and stimulated a broader collective differential diagnosis. Many hospitals have strategies to ensure that critical radiographic findings are promptly communicated by radiologists, but some systematic process may also be necessary to call attention to ostensibly sub-critical but discordant findings, triggering more careful consideration.

Ideally, this patient with a thoracic esophageal perforation causing mediastinitis would have been treated with urgent drainage and primary repair, even if the perforation were unrecognized for more than 24 hours.⁹ Certain factors, such as extensive mediastinal necrosis, a large esophageal defect, or severe systemic illness, might argue for a temporizing drainage (esophageal “T”-tube) or diversion procedure (e.g., esophagectomy, cervical esophagostomy, gastrostomy tube placement, and pleural drain placement). Involvement of a thoracic or general surgeon with experience in esophageal disease is important, as most general surgeons currently do not encounter sufficient volume of such problems to become or stay proficient in optimal care. However, whatever definitive treatment is ultimately selected, the obligatory first step to actuate such care is, of course, to conceive of an esophageal perforation as a possible diagnosis.

Take Home Points

- Esophageal perforation is a rare and serious but surgically treatable emergency.
- Even in the absence of a history suggestive of esophageal perforation (instrumentation, injury, vomiting/retching), mediastinal gas or an unexplained hydropneumothorax in a systemically ill patient should prompt urgent evaluation by a surgeon and testing such as contrast

esophagography.

- Strategies to combat cognitive biases involved in diagnostic errors are in their infancy, but multidisciplinary discussion of complex cases may facilitate both accurate diagnosis as well as other aspects of care.
- Gathering accurate information, forming thoughtful differential diagnoses, and iteratively testing hypothetical diagnoses remain the bedrock of effective diagnostic ability.

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