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The Non-Resolving Empyema: Rapid Bedside Diagnosis of an Esophageal Rupture Using Methylene Blue Administration

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Abstract

Diagnosis of *de novo* esophageal rupture is generally obtained via esophagram. In this case, we present a patient with an esophageal tear, initially presenting as a non-resolving empyema, but ultimately diagnosed based on methylene blue administration at bedside. In the case of critically ill patients who are unable to tolerate more advanced studies, methylene blue delivered through a nasogastric or orogastric lumen is a rapid bedside test that can yield a diagnosis in patients with involvement of the pleural space. This case serves as a reminder of the importance of being cognizant of anchoring bias when evaluating patients, as well as the utility of methylene blue in evaluation of a suspected esophageal rupture.

Keywords: Esophageal rupture • Methylene blue • Empyema

Introduction

Esophageal rupture is a surgical emergency associated with high morbidity and mortality if not diagnosed within a timely manner. Defined as a perforation from a full-thickness tear through the mucosa, esophageal rupture can present in a variety of non-specific forms, which can make diagnosis difficult [1,2]. Depending on the location of the perforation (i.e., - cervical, thoracic, or abdominal), patients may present with involvement of the prevertebral space, the mediastinum, the thoracic cavity, or the abdominal cavity, which may correlate to a wide array of clinical symptoms from a mild cough to mediastinal sepsis.

The two mainstays of diagnostic evaluation for esophageal tear injury include a plain chest radiograph or a computerized tomography (CT) of the chest and upper abdomen. Either study performed with water-soluble oral contrast can demonstrate leakage of contrast medium allowing for localization and diagnosis. However, in acutely ill patients who are unable to tolerate oral intake, these studies may demonstrate non-specific findings, including widened mediastinum, subcutaneous emphysema, or a thickened esophageal wall.

Here, we present a patient with a delayed diagnosis of an esophageal tear, initially presenting as a non-resolving empyema, which was ultimately discovered based on methylene blue administration at bedside. Although not commonly used as a diagnostic tool, this method allowed for rapid confirmation of our suspicion without the use of advanced imaging.

Case Presentation

A 67-year-old man was brought to the emergency department after being found down on the street. Upon initial evaluation, the patient had a right-sided tension pneumothorax for which a 14 French chest tube was placed (Figure 1) with mild improvement in the pneumothorax. Eight hours later, the patient became increasingly hypoxic with significant serous chest tube output. Thus, the initial drain was exchanged for a 32 French chest tube and admitted to the ICU. Studies from admission demonstrated 19,000 nucleated cells/mm^3 with 93% neutrophilia and polymicrobial bacteria that grew out on cultures. On hospital day 5, there was concern for development of a loculated empyema, so an additional 14 French chest tube was placed posteriorly over the right hemithorax with resultant copious effluent.

On hospital day 8, the patient's tube feeding rate was advanced with a marked increase in the pleural fluid output closely matching the nasogastric feeding input. Repeat pleural fluid studies from the 14 French chest tube demonstrated amylase 4372 u/L, glucose 505 mg/dL, LDH >5000 u/L, triglycerides 866 mg/dL, which were concerning for the presence of tube feedings leaking into the pleural space. In order to confirm this suspicion, 10 mg of methylene blue was diluted into 60 mL of normal saline and flushed slowly into the patient's nasogastric tube. Within seconds of administration, the posterior chest tube drainage demonstrated a green tinge (Figure 2).

Figure 1. Chest radiograph following initial 14 French chest tube placements with mild improvement in right-sided pneumothorax.

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Figure 2. Demonstration of positive methylene blue test with green discoloration in posterior chest tube following nasogastric administration of methylene blue.

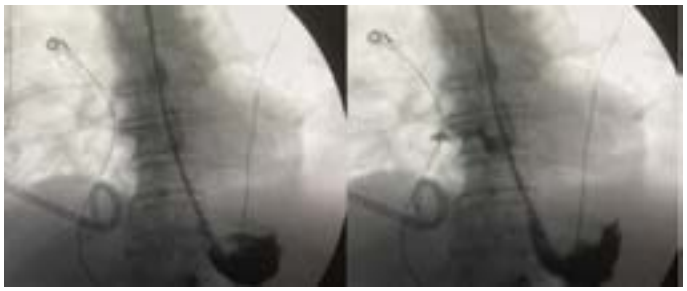

Figure 3. Esophagram demonstrating right sided esophageal defect.

On day 14, to localize the suspected esophageal defect, the patient underwent an esophagram with water-soluble contrast which demonstrated a distal right-sided esophageal defect with subsequent leakage of contrast into the pleural space (Figure 3).

On hospital day 16, gastroenterology performed an esophagogastroduodenoscopy (EGD) with stent placement. Notably, the EGD demonstrated a loose tooth in the gastric cavity. The remainder of the patient's hospital course was complicated by renal failure and the patient eventually passed on hospital day 31.

Discussion

Given its ability to localize the lesion, the esophagram is the gold-standard for diagnosis of esophageal tears [3]. However, in the case of critically ill patients who are unable to tolerate more advanced studies or in a resource-limited setting, methylene blue delivered through a nasogastric or orogastric lumen should be considered as an alternative.

Methylene blue administration is commonly used by surgical colleagues to evaluate the esophageal anastomoses - both intra and post-operatively [4-7] and prophylactic intraoperative peri-anastomotic drain placement has been associated with minimizing the delay to diagnosis of a post-operative leak [8].

There are clear limitations to this bedside evaluation, including that the patient must already have a sizable, drainable pleural effusion. Our patient's case demonstrated pleural fluid studies consistent with esophageal rupture [8] - including elevated pleural fluid amylase, triglyceride, and LDH levels. Unfortunately, these studies were not obtained until day 8 of hospitalization, which likely contributed to the delayed diagnosis of esophageal compromise [9-11].

Conclusion

Our re-evaluation of the patient in the context of their hospital course, and specifically, their worsening hypoxia in the setting of increased rate of tube feedings, pointed us to an alternative pathophysiologic process than just a complicated empyema. Due to the high rates of mortality associated with delayed diagnosis of esophageal rupture, it is essential that this condition be considered on the differential for patients with a non-resolving empyema.

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