Esophageal Perforation

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Learning Objectives

- Discuss esophageal anatomy
- Discuss findings of esophageal perforation on chest radiograph, barium swallow and endoscopy
- Consider differentials for esophageal perforation
  - Esophageal ulcers: Presentation, diagnosis and management
  - Boerhaave syndrome: Presentation, diagnosis and management
- Discuss endoscopic stent placement for esophageal perforation management
  - Different options of stents
  - Potential complications
An 86-year-old female (Ms. XY) presented to an outside hospital with
- Nausea and vomiting (several days)
- Dyspnea (several hours)

Chest radiograph revealed a right pneumothorax
Chest tube output was purulent, thick with food particles
A swallow study was performed
# ACR Appropriateness Criteria for Acute Respiratory Illness

**Clinical Condition:** Acute Respiratory Illness in Immunocompetent Patients

**Variant 1:** Older than age 40.

<table>
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<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRL*</th>
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*Relative Radiation Level

**Rating Scale:** 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate.
Finding(s):
- Interstitial pulmonary edema
- Bilateral effusion (left greater than right)
- Mediastinal widening
- Retrocardiac density suggesting modest hiatal hernia
- Chest tube
- Central line
Our Patient: Initial Swallow Study

Fluoroscopic image of a barium swallow study.

Finding(s):
- Esophageal perforation leading to barium leak
Our Patient: Findings and Intervention

- Esophageal defect
- 2-3 cm ulcer at the location close to the GE junction
- Esophageal stent placed
- Maintained NPO
Esophageal Anatomy

- Length: 18-26 cm
- Four layers: Innermost mucosa, submucosa, muscularis propria, and adventitia; No serosa
- Muscular layers:
  - External layer: Longitudinal fibers
  - Internal layer: Circular fibers
    - Involved in peristaltic contraction to push food downward
- Three anatomical points of narrowing prone to perforation
  - Cricopharyngeus muscle
  - Broncho-aortic constriction
  - Esophagogastric junction
Muscles of the Esophagus
Three Anatomical Points of Narrowing

- Incisors: 0 cm
- Cricopharyngeus muscle: 14 - 16 cm
- Broncho-aortic constriction: 22 - 24 cm
- Esophagogastric junction: 40 - 45 cm

Cricoid cartilage
Cervical part of esophagus
Thoracic part of esophagus
Diaphragm
Abdominal part of esophagus
Esophageal Perforation Differentials

- Ulcer
- Spontaneous perforation: Boerhaave Syndrome
- Areas of anatomic narrowing
- >50% iatrogenic (especially endoscopies)
- Foreign body ingestion
- Trauma
- Malignancy
Differentials Discussed Today

- Ulcer
- Spontaneous perforation: Boerhaave Syndrome
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Differentials Discussed Today

- **Ulcer**
- **Spontaneous perforation: Boerhaave Syndrome**
- Areas of anatomic narrowing
- >50% iatrogenic (especially endoscopies)
- Foreign body ingestion
  - Fishbone
- Trauma
- Malignancy
Esophageal Ulcers

- Most commonly due to gastroesophageal reflux disease → Acid and pepsin erodes the esophageal mucosa → Ulcers

- Other causes include
  - NSAID
  - Crohn’s Disease
  - HSV
  - CMV
  - HIV

- May lead to stricture, hemorrhage, perforation
Esophageal Ulcers Secondary to HSV

Endoscopic image of esophageal ulcers
Clinical Presentation

- Retrosternal chest pain
- Dysphagia
- Hematemesis
- Abdominal pain
- Weight loss
- History of medication ingestion without water or during bedtime if medication induced
Methods of Diagnosis

- Clinical presentation
- Upper endoscopy
- Barium esophagram
Esophageal Perforation Secondary to Ulcer

Endoscopic image of an esophageal ulcer

Higuchi et al., 2003
Management

- Manage underlying medical causes
  - GERD: Proton pump inhibitors
  - Discontinue medications (NSAIDS)
- Stricture $\rightarrow$ dilatation of esophagus
- Perforation $\rightarrow$ segmental esophageal resection\(^7\)
  - Esophageal resection with high risk of mortality (12-50\%)\(^6\)
Let’s Continue to Discuss the Second Differential
Differentials Discussed Today

- Ulcer
- **Spontaneous perforation: Boerhaave Syndrome**
- Areas of anatomic narrowing
- >50% iatrogenic (especially endoscopies)
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  - Fishbone
- Trauma
- Malignancy
Boerhaave Syndrome

- Increased intraesophageal pressure → spontaneous rupture of esophagus.
- Vomiting, seizure, childbirth, prolonged coughing
- Rupture can occur in distal intrathoracic (most common), intra-abdominal or cervical esophagus.
- Gastric contents released in the mediastinum → chemical mediastinitis → mediastinal necrosis.
- Can also cause pericarditis, cardiac tamponade
- Pleural effusion possible if pleural rupture occurs
Clinical Presentation

- Retrosternal chest pain
- Subcutaneous emphysema: crepitus on chest palpation
  - Hamman’s sign: Mediastinal emphysema → mediastinal crackling with each heartbeat
- Pleural effusion
- Neck pain, dysphagia, dysphonia$^{12}$
- Note: 25 – 45% patients with no history of vomiting$^{10}$
Methods of Diagnosis

- Clinical symptoms with physical findings
- Radiograph, CT
- Contrast esophagram
- Laboratory findings: thoracentesis revealing food contents, pH < 6$^{12}$
Boerhaave Syndrome: Chest Radiograph

Chest radiograph revealing mediastinal air.
Our patient’s course highlighted
Endoscopic Therapy

- Non-surgical candidates
- Goal: Seal the perforation and prevent esophageal collapse
- Three types of stents:
  - Uncovered
    - Complication: Granulation tissue ingrowth
  - Fully covered
    - No exposed bare metal
    - Complication: Migration
  - Partially covered
    - Ends with exposed bare metal
    - Decreased migration\textsuperscript{13}
- Self-expandable metal stents (SEMS) and self-expandable plastic stents (SEPS)
Endoscopic Stent Images

Dilatation of esophageal stent and sealing of the wall

After stent removal; closed perforation and granulomatous tissue present
Complications

- Esophagram one or two days after stent placement to check if perforation sealed
- Stent migration (need to replace or reposition)
- Need to remove within 6 weeks
  - Inflammation $\rightarrow$ degeneration of esophageal layers\textsuperscript{15}
- Significant rates of reintervention
  - 81% initial success
  - 17% endoscopic reintervention
  - 10% surgical reintervention\textsuperscript{16}
Our Patient: Stent Complications

- Repeat swallow study showed persistent esophageal leak
- Transferred to BIDMC for surgical evaluation
Swallow Study Pre-Contrast

Fluoroscopic image of a barium swallow study.

Finding(s):
- Stent
Swallow Study Post-Contrast

Fluoroscopic image of a barium swallow study.

Finding(s):
- Contrast leakage
- Stent
Fluoroscopic image of a barium swallow study.

Finding(s):
- Contrast leakage
- Stent

Swallow Study Post-Contrast
Our Patient: Conclusion

- She continued to experience respiratory distress.
- Her goals of care were changed to comfort measures only after discussion with family.
- She was placed on a morphine drip.
- She passed away due to acute respiratory failure with family by her bedside.
Learning Objectives Discussed

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Acknowledgments

- Ms. XY
- Gillian Lieberman, MD
- Joseph Bravoco, MD
- Katie Armstrong
- Classmates
References:


2. Uptodate: Overview of gastrointestinal tract perforation


12. Uptodate: Boerhaave syndrome: Effort rupture of the esophagus


