

# Esophageal Perforation

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# Learning Objectives

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- ▶ 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

# Our Patient: Presentation and Initial Course

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- ▶ 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

Last review date: 2013

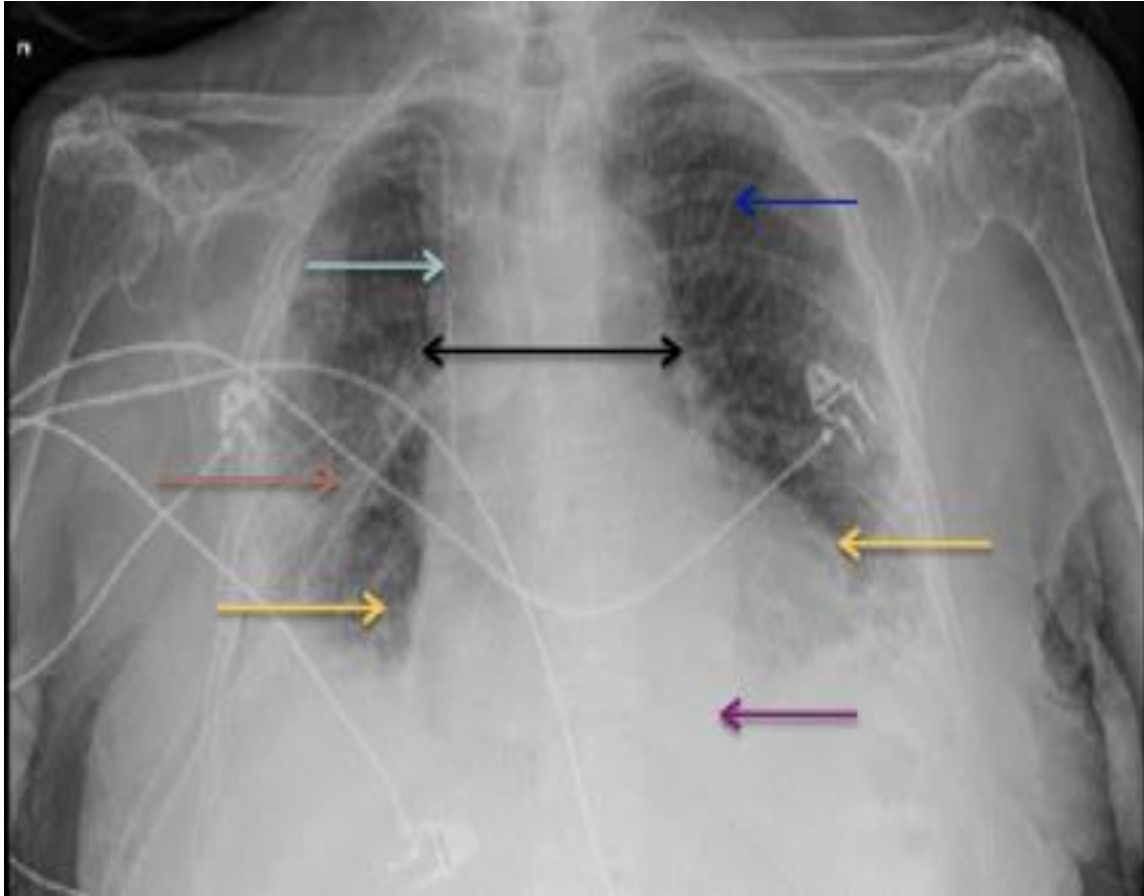
## American College of Radiology ACR Appropriateness Criteria®

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

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

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	8		☼
CT chest without IV contrast	4		☼ ☼ ☼
CT chest with IV contrast	3		☼ ☼ ☼
CT chest without and with IV contrast	1		☼ ☼ ☼
<b><u>Rating Scale:</u></b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

# Our Patient: Chest Radiograph

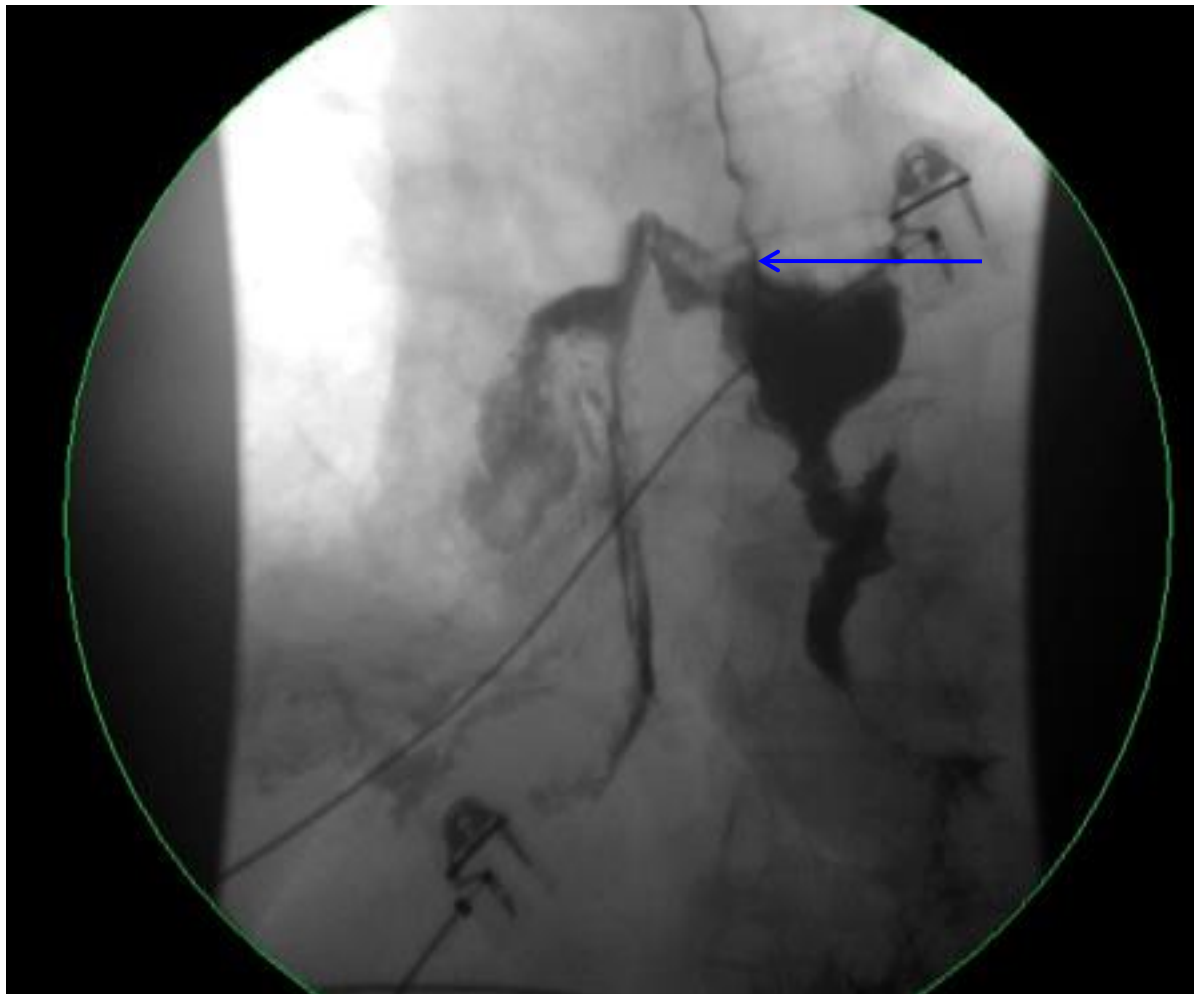


Finding(s):

- 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

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Fluoroscopic  
image of a  
barium swallow  
study.

Finding(s):  
- Esophageal  
perforation  
leading to barium  
leak

# Our Patient: Findings and Intervention

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

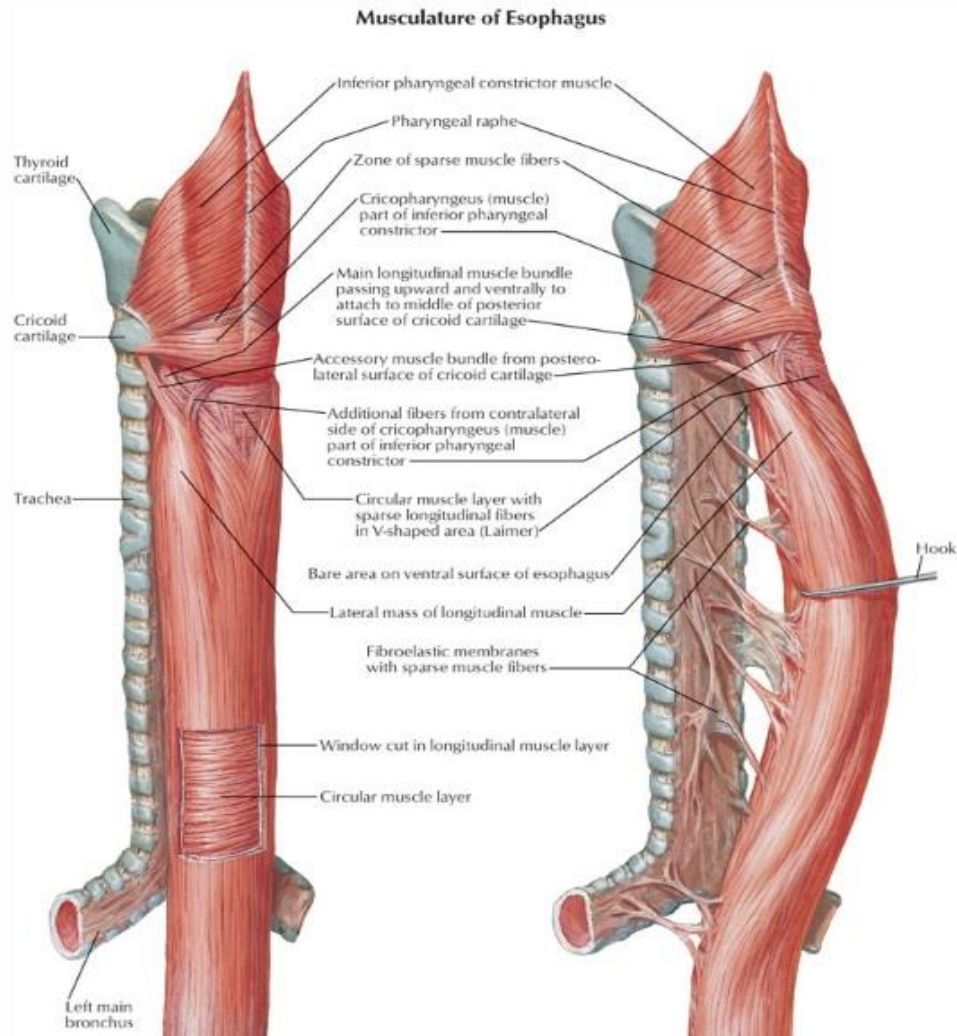
# Esophageal Anatomy

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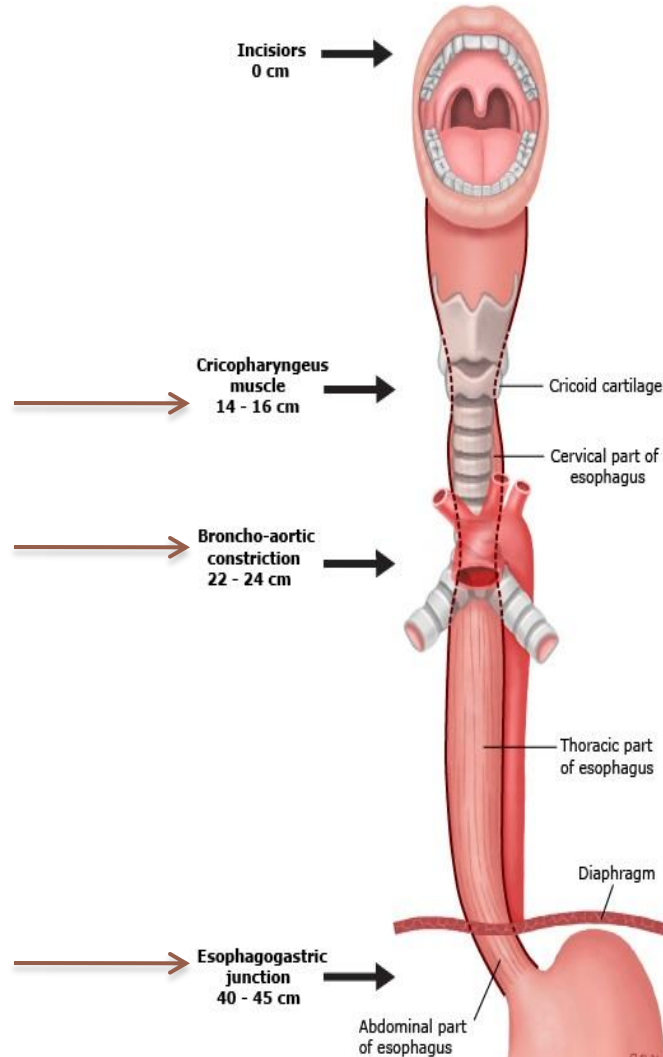
- ▶ Length: 18-26 cm
- ▶ Four layers: Innermost mucosa, submucosa, muscularis propria, and adventitia; No serosa
- ▶ Muscular layers:
  - ▶ External layer: Longitudinal fibers
  - ▶ Internal layer: Circular fibers
    - ▶ Involved in peristaltic contraction to push food downward
- ▶ Three anatomical points of narrowing prone to perforation
  - ▶ Cricopharyngeus muscle
  - ▶ Broncho-aortic constriction
  - ▶ Esophagogastric junction<sup>3</sup>



# Muscles of the Esophagus



# Three Anatomical Points of Narrowing



# Esophageal Perforation Differentials

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- ▶ Ulcer<sup>4</sup>
- ▶ Spontaneous perforation: Boerhaave Syndrome
- ▶ Areas of anatomic narrowing
- ▶ >50% iatrogenic (especially endoscopies)
- ▶ Foreign body ingestion
- ▶ Trauma
- ▶ Malignancy<sup>5</sup>

# Differentials Discussed Today

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- ▶ **Ulcer<sup>4</sup>**
- ▶ **Spontaneous perforation: Boerhaave Syndrome**
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# Esophageal Ulcers

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- ▶ 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<sup>6</sup>
- ▶ May lead to stricture, hemorrhage, perforation<sup>7</sup>

# Esophageal Ulcers Secondary to HSV



Endoscopic image  
of esophageal ulcers

# Clinical Presentation

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



# Methods of Diagnosis

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- ▶ Clinical presentation
- ▶ Upper endoscopy
- ▶ Barium esophagram

# Esophageal Perforation Secondary to Ulcer



Endoscopic image  
of an esophageal  
ulcer

# Management

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- ▶ Manage underlying medical causes
  - ▶ GERD: Proton pump inhibitors
  - ▶ Discontinue medications (NSAIDS)
- ▶ Stricture → dilatation of esophagus
- ▶ Perforation → segmental esophageal resection<sup>7</sup>
  - ▶ Esophageal resection with high risk of mortality (12-50%)<sup>6</sup>

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# Let's Continue to Discuss the Second Differential

# Differentials Discussed Today

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- ▶ **Ulcer<sup>4</sup>**
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# Boerhaave Syndrome

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- ▶ Increased intraesophageal pressure → spontaneous rupture of esophagus.
- ▶ Vomiting, seizure, childbirth, prolonged coughing<sup>9</sup>
- ▶ 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<sup>11</sup>
- ▶ Pleural effusion possible if pleural rupture occurs<sup>10</sup>

# Clinical Presentation

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- ▶ 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<sup>12</sup>
- ▶ Note: 25 – 45% patients with no history of vomiting<sup>10</sup>

# Methods of Diagnosis

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- ▶ Clinical symptoms with physical findings
- ▶ Radiograph, CT
- ▶ Contrast esophagram
- ▶ Laboratory findings: thoracentesis revealing food contents, pH < 6<sup>12</sup>



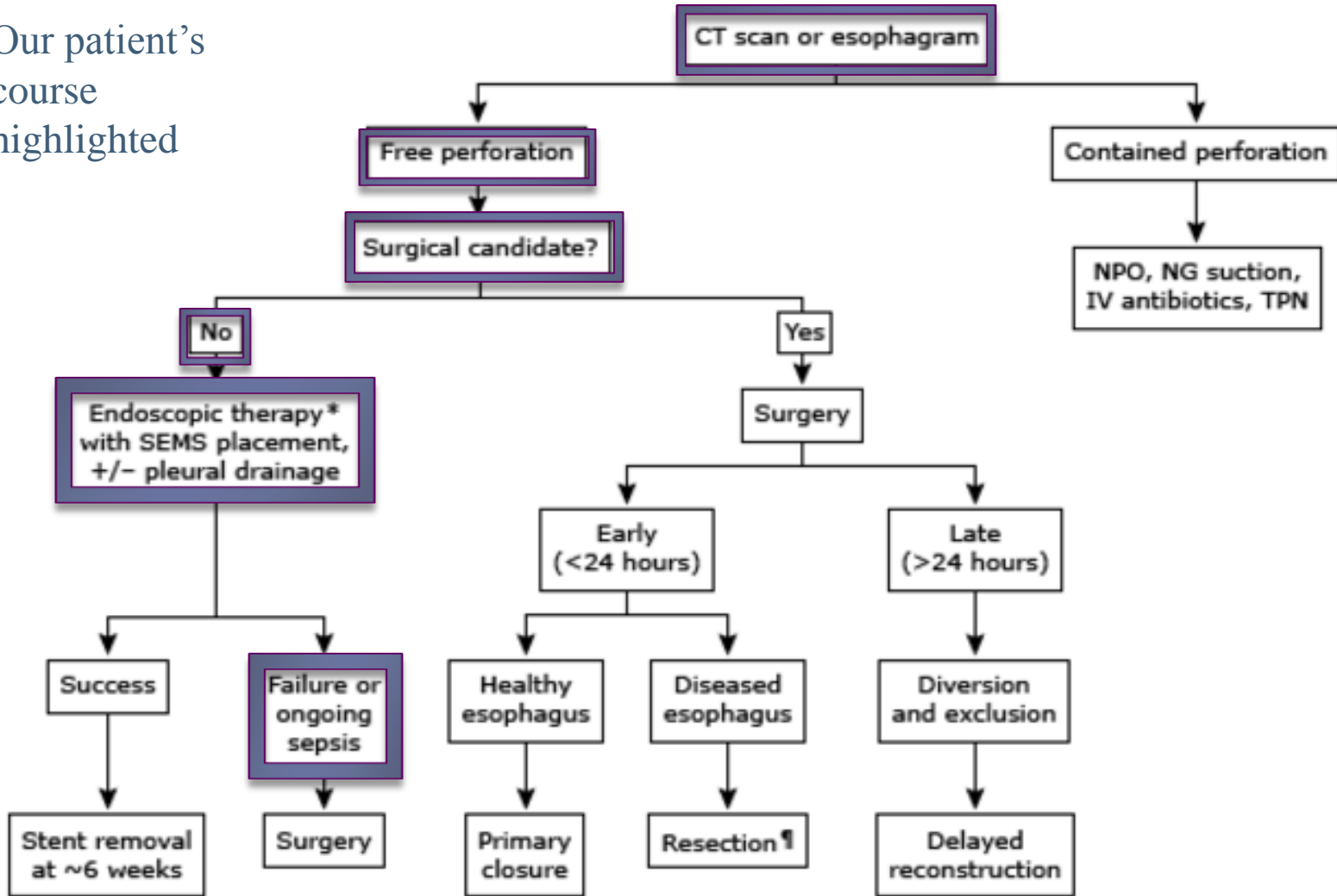
# Boerhaave Syndrome: Chest Radiograph



Chest radiograph  
revealing  
mediastinal air

# Management Algorithm

Our patient's course highlighted



# Endoscopic Therapy

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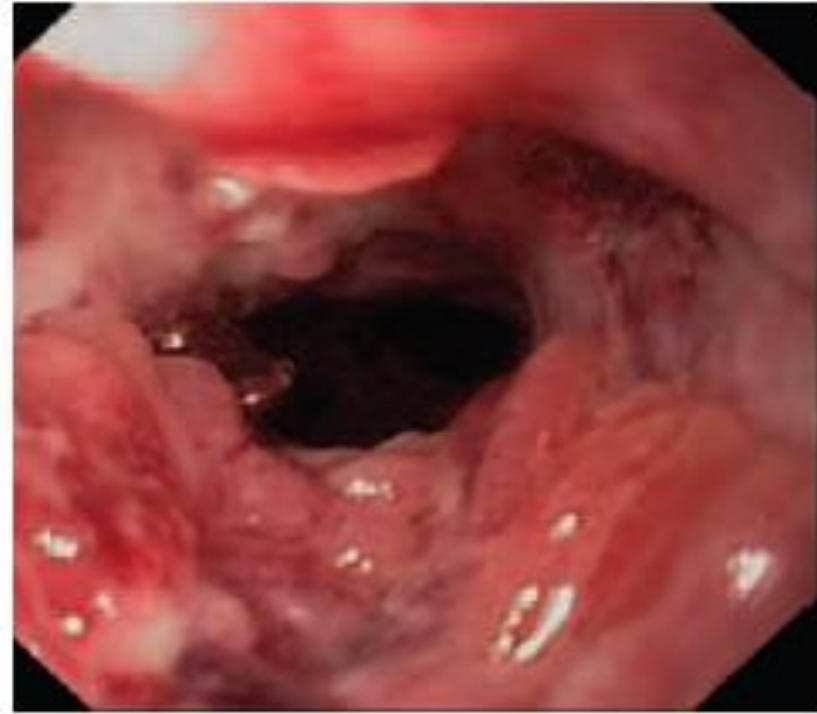
- ▶ Non-surgical candidates
  - ▶ Goal: Seal the perforation and prevent esophageal collapse
  - ▶ Three types of stents:
    - ▶ Uncovered
      - ▶ Complication: Granulation tissue ingrowth
    - ▶ Fully covered
      - ▶ No exposed bare metal
      - ▶ Complication: Migration
    - ▶ Partially covered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

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Dilatation of esophageal **stent** and sealing of the wall



After stent removal; closed perforation and granulomatous tissue present

# Complications

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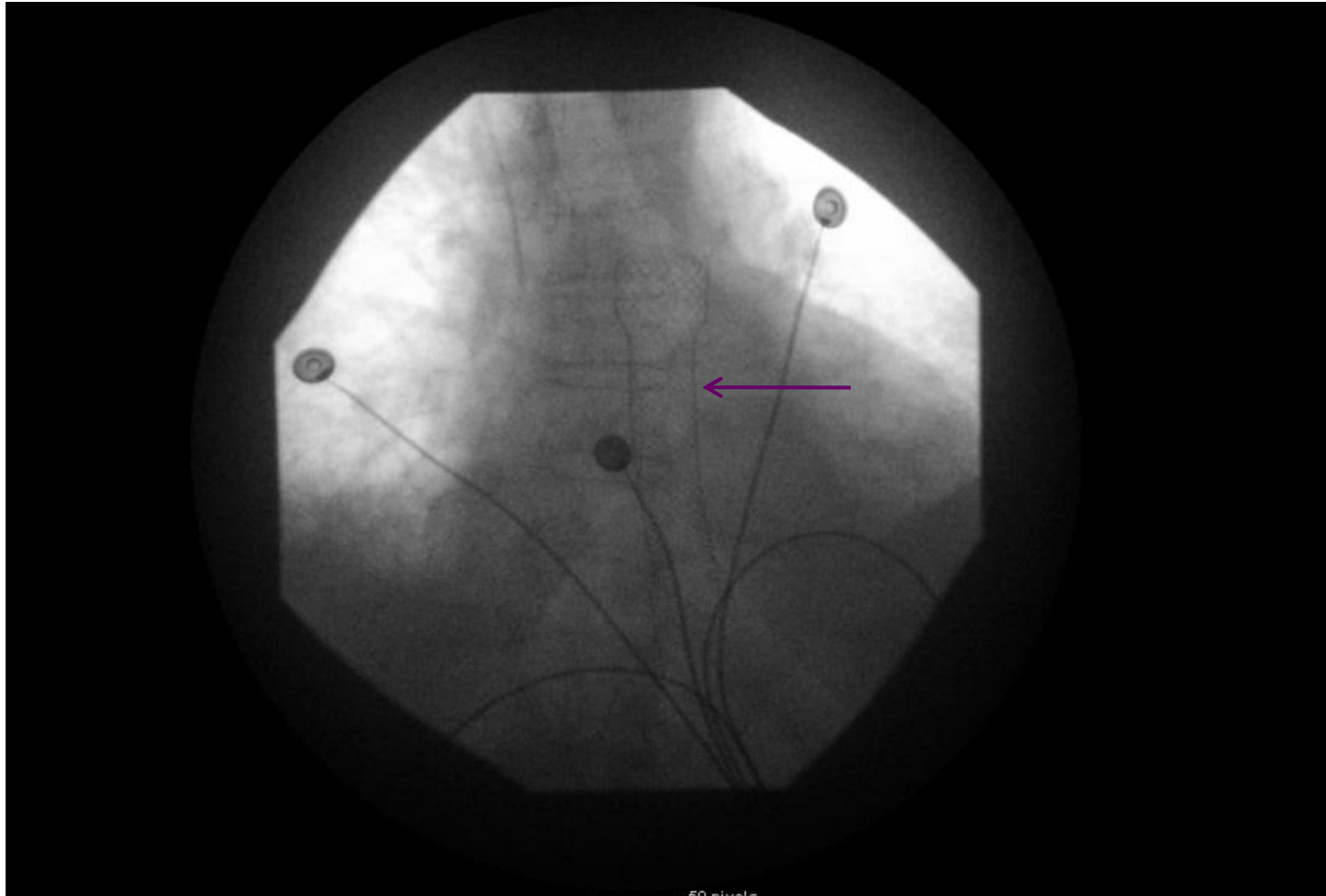
- ▶ Esophagram one or two days after stent placement to check if perforation sealed
- ▶ Stent migration (need to replace or reposition)
- ▶ Need to remove within 6 weeks
  - ▶ Inflammation → degeneration of esophageal layers<sup>15</sup>
- ▶ Significant rates of reintervention
  - ▶ 81% initial success
  - ▶ 17% endoscopic reintervention
  - ▶ 10% surgical reintervention<sup>16</sup>

# Our Patient: Stent Complications

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- ▶ Repeat swallow study showed persistent esophageal leak
- ▶ Transferred to BIDMC for surgical evaluation

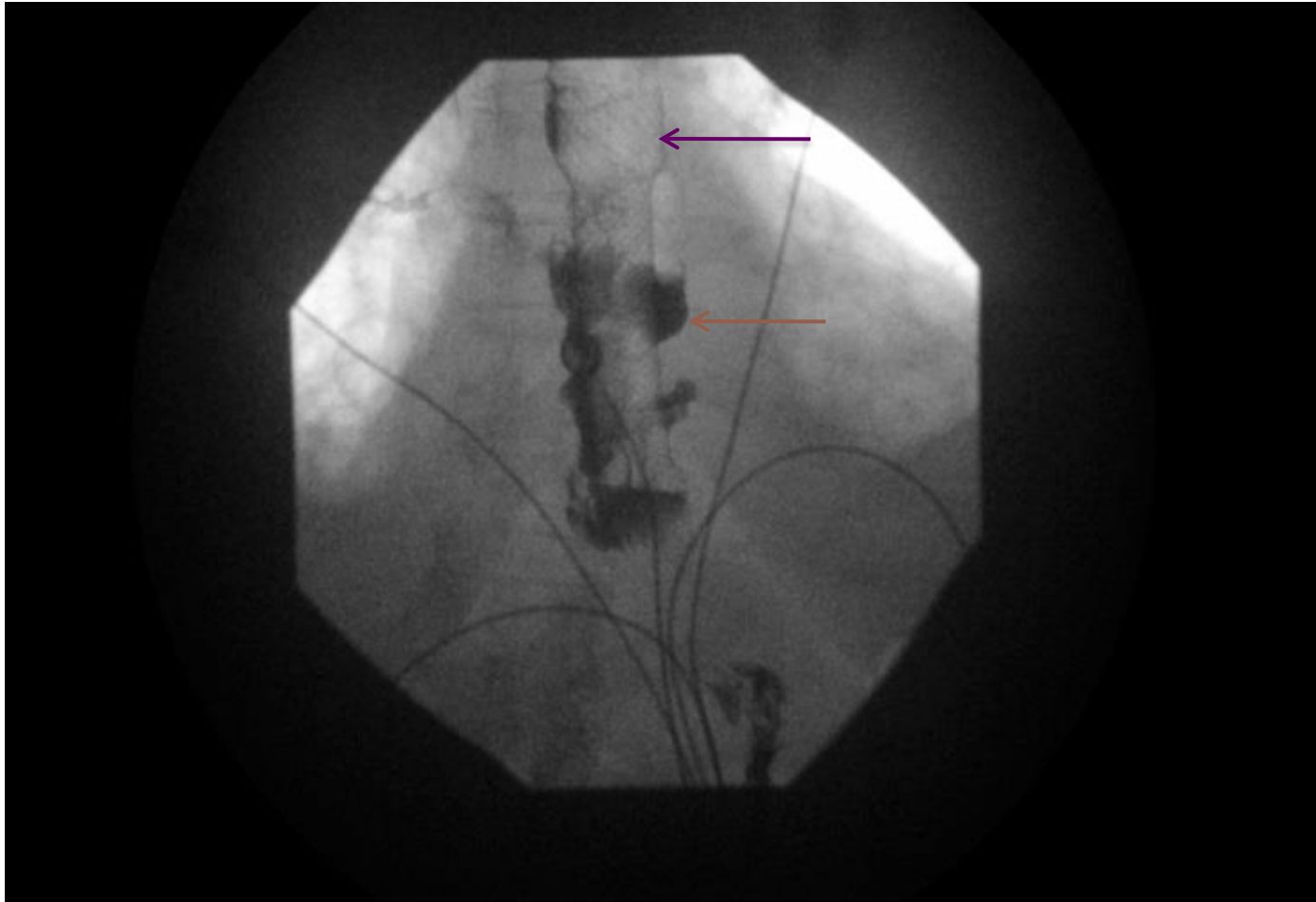
# Swallow Study Pre-Contrast



Fluoroscopic image of a barium swallow study.

Finding(s):  
- Stent

# Swallow Study Post-Contrast

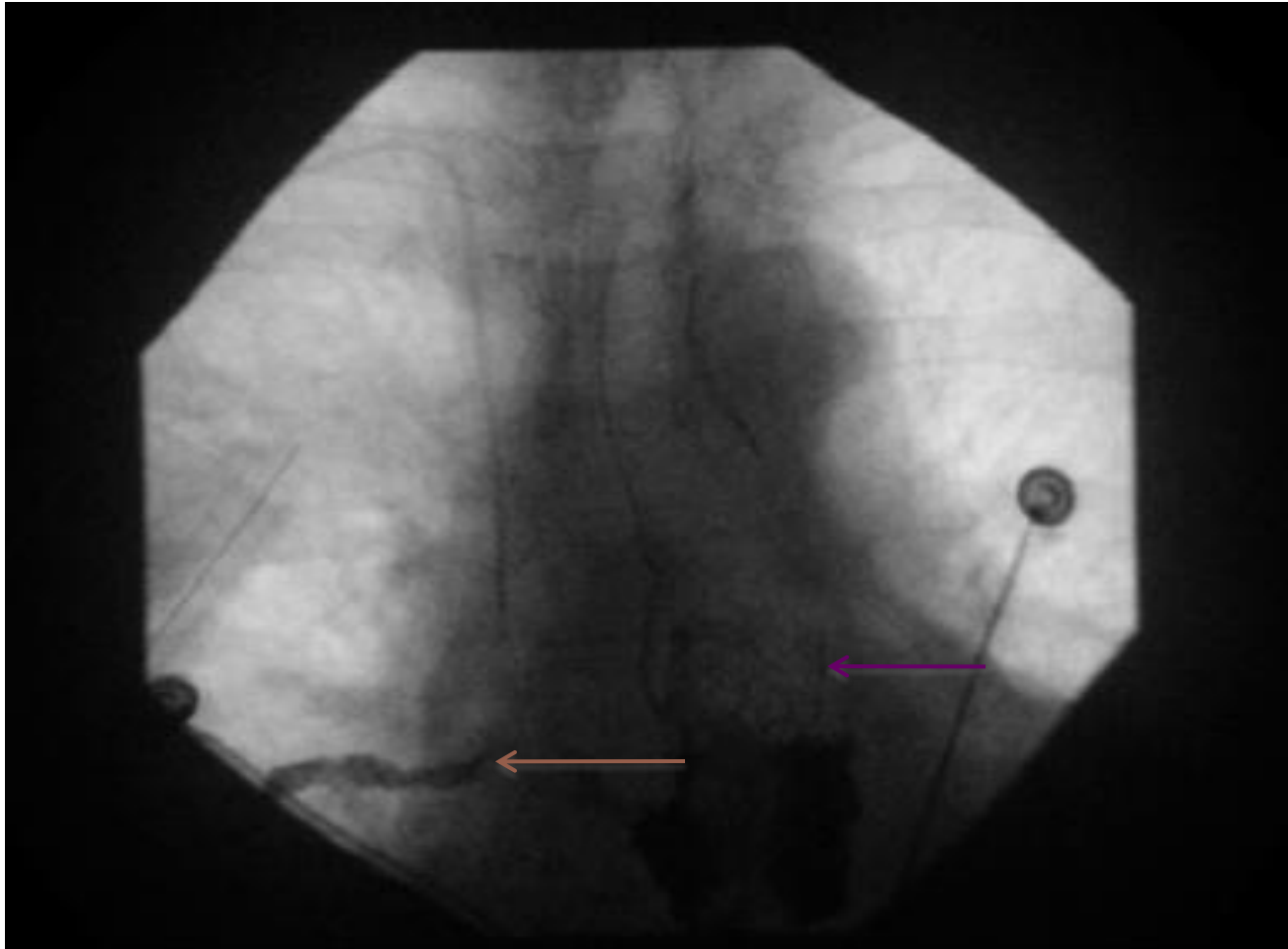


Fluoroscopic  
image of a  
barium  
swallow study.

Finding(s):  
- Contrast  
leakage  
- Stent



# Swallow Study Post-Contrast



Fluoroscopic  
image of a  
barium swallow  
study.

Finding(s):  
- Contrast  
leakage  
- Stent

# Our Patient: Conclusion

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- ▶ 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.

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# Acknowledgments

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

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