



# ESOPHAGEAL PERFORATION

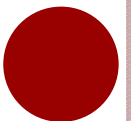
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University of Louisville  
Gastroenterology, Hepatology, and Nutrition  
January 24, 2013

## OUTLINE

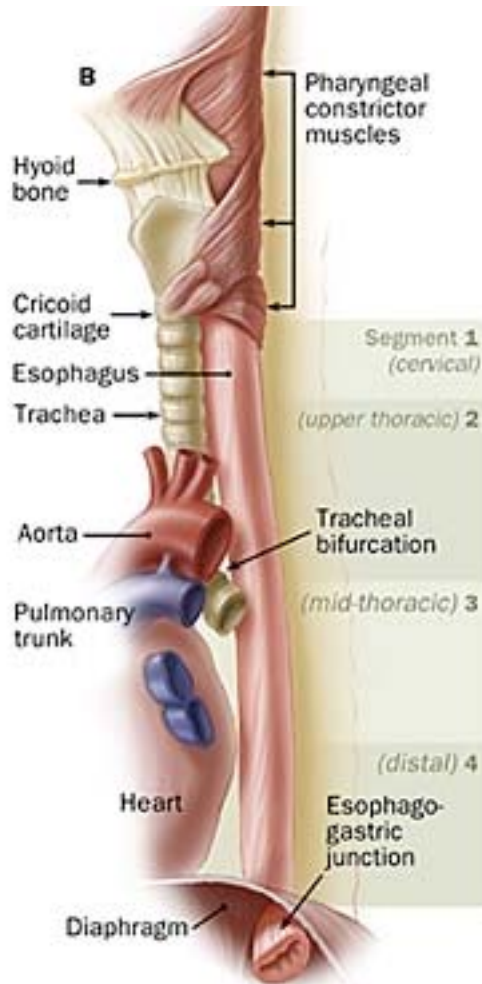
- Risk factors
- Diagnosis
- Management

## GOALS

- Make sure you don't miss it
- If it happens, know what your treatment options are and who to call



# ESOPHAGEAL ANATOMY



## POINTS OF NARROWING

1

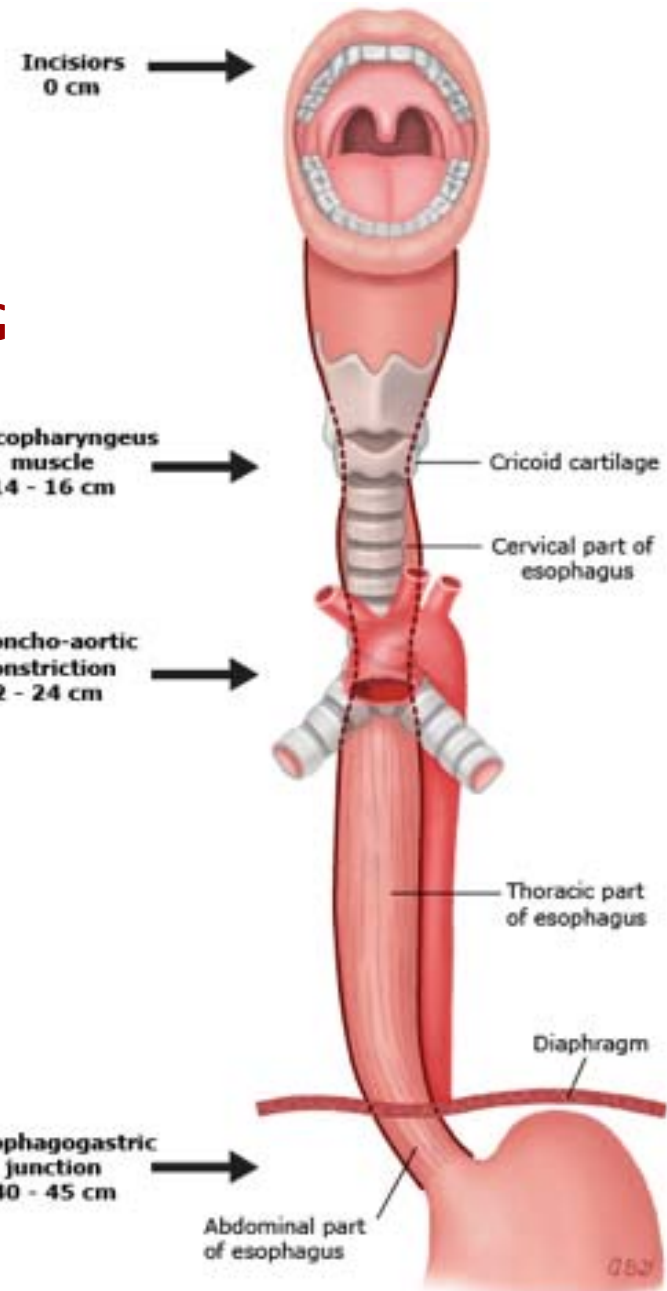
Cricopharyngeus muscle  
14 - 16 cm

2

Broncho-aortic constriction  
22 - 24 cm

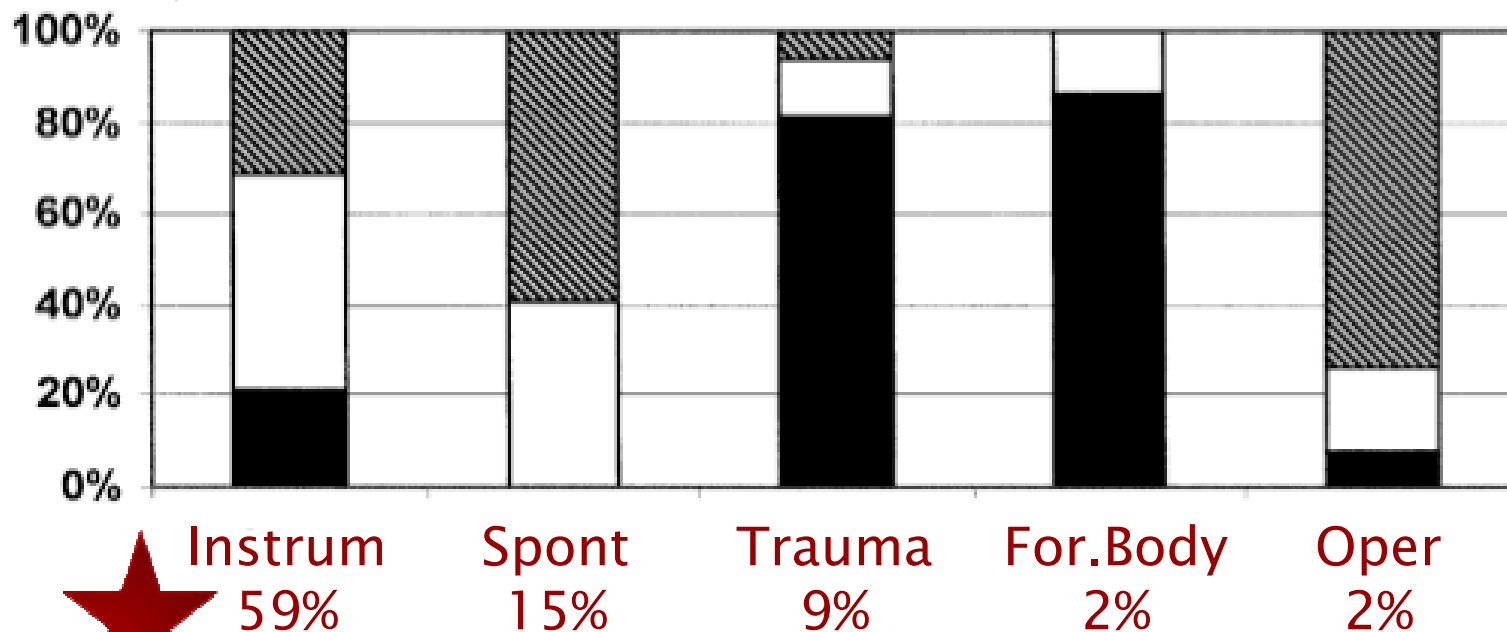
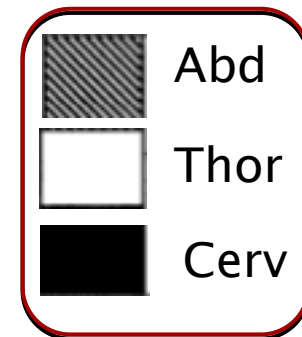
3

Esophagogastric junction  
40 - 45 cm



# PERFORATION BY LOCATION/CAUSE

- 1990 – 2003
- 550 pts with E.P.
- Malignancy 1 %

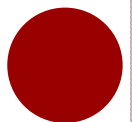


# PERFORATION RISK

Rigid Endoscopy

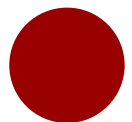
0.1 – 0.4 %

Endoscopic procedure	Esophageal perforation risk
Diagnostic	0.03%
Dilation	0.25% (normal esophagus) 4%-7% (achalasia)* 7% (gastric outlet obstruction)* 17% (strictures due to caustic agent)
Thermal method (treatment of malignancy)	10% <sup>†</sup>
Endoprosthesis	3% <sup>‡</sup>
Variceal sclerotherapy	1%-5% (acute perforation) 2%-5% (delayed perforation)
Band ligation	0.7% (perforation)
Nonvariceal hemostasis (use of sclerosant or cautery)	0%-2% (first hemostasis) 4% (hemostasis repeated within 24-48 hours)



# RISK FACTORS

Endoscopist	Level of Experience
Underlying Esophageal Disorder	Zenker's Diverticulum
	Eosinophilic Esophagitis
	H/O Irradiation
	Malignancy
	Stricture
	Anterior Cervical Osteophytes
Systemic Disorder	Cirrhosis
	DM
	Scleroderma
Intervention	Stent Placement
	Pneumatic Dilation
Other	Heavy Sedation
	Advanced Age

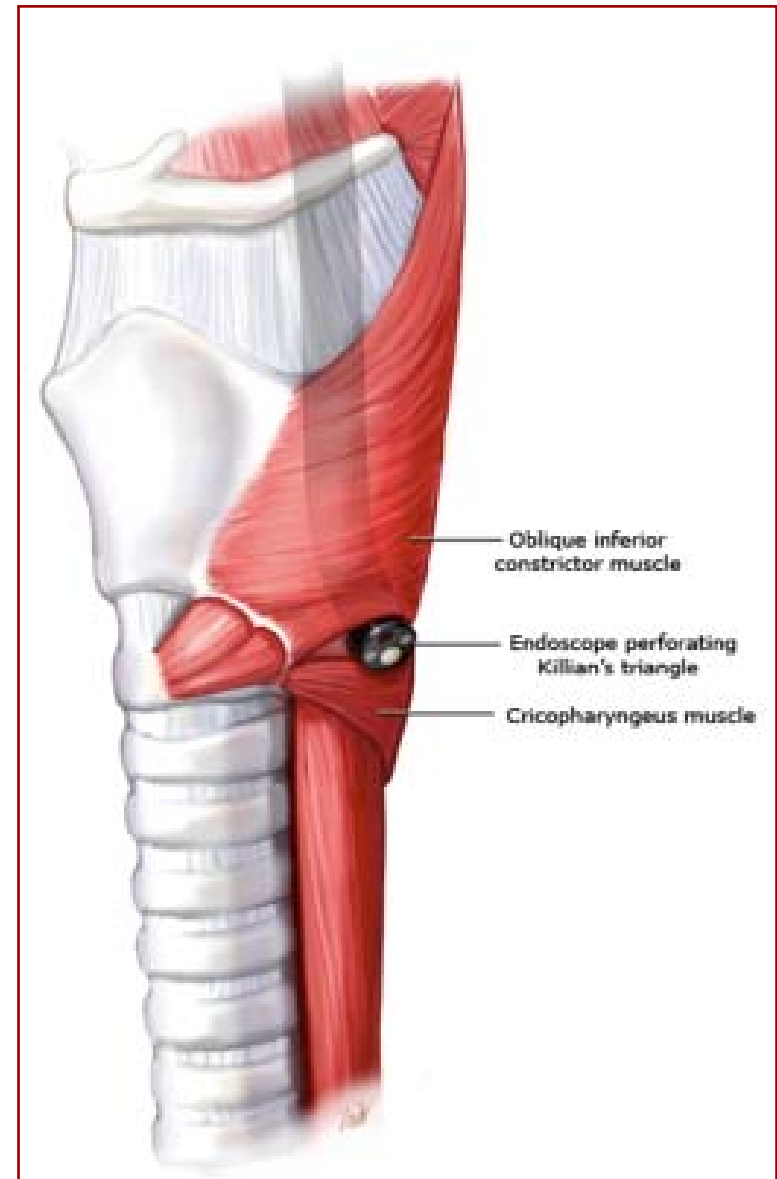


# CERVICAL ESOPHAGUS

- Greatest risk = Killian's triangle
  - Formed by inf. constrictor pharyngeus and cricopharyngeus muscles
- Post. esoph unprotected by muscle
  - Only has buccopharyngeal fascia
- Also at risk from
  - Osteophytes
  - Kyphosis
  - Neck hyperextension

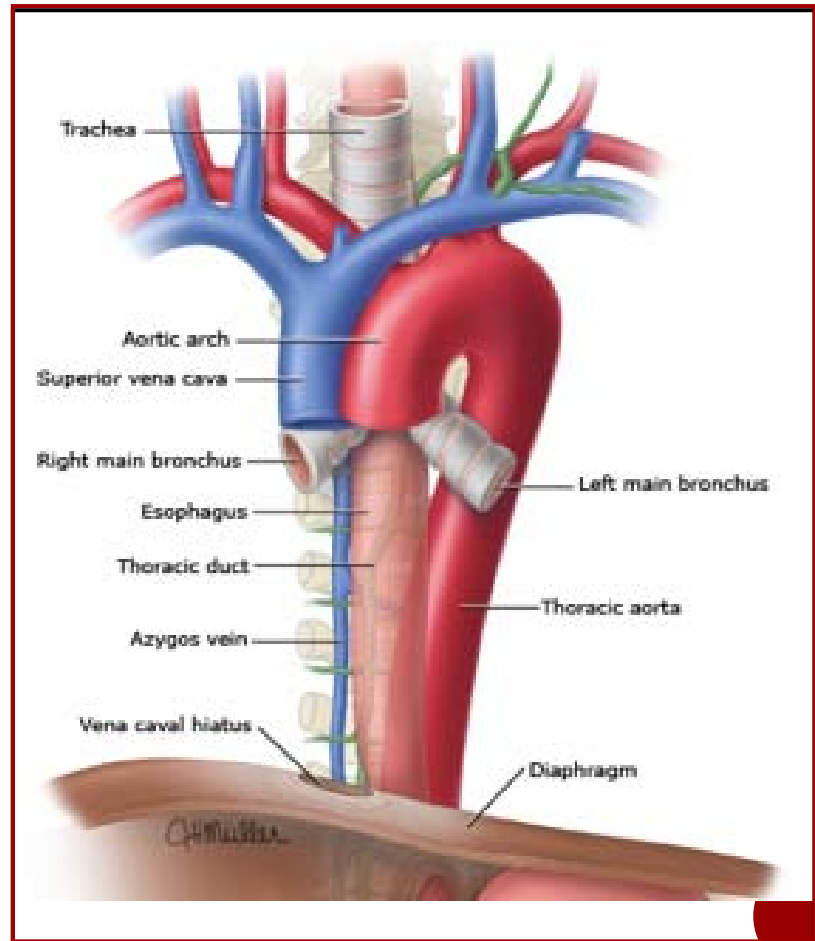
## GOOD NEWS:

Lower mortality due to anatomical planes that limit contamination/infection



# THORACIC ESOPHAGUS

- Rapidly contaminate the mediastinum
- May extend into the pleural cavity (freq L)
- Gastric contents → mediastinum
  - Chemical mediastinitis → bacterial infection → necrosis
  - The negative intrathoracic pressure draws further leakage into the pleural space
  - Frequently cause rapid deterioration with septic shock





# SIGNS/SYMPTOMS

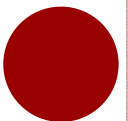
Location of perforation	Symptom	Sign*
Cervical esophagus	Muscle spasm	Anterior neck tenderness
	Dysphonia	Tenderness on cervical motion
	Hoarseness	Subcutaneous emphysema
	Dysphagia	
Thoracic esophagus	Substernal chest pain	Cyanosis, Dyspnea
	Dysphagia	Hamman's sign <sup>†</sup>
	Odynophagia	Pleural effusion
		Subcutaneous emphysema
Intraabdominal esophagus	Epigastric pain	Acute abdomen Subcutaneous emphysema

\*Patient can present with fever, sepsis, and/or shock regardless of perforation site.

<sup>†</sup>An audible crunch with chest auscultation that may vary with the cardiac cycle; this finding is associated with mediastinal emphysema. Data from Duncan and Wong.<sup>8</sup>

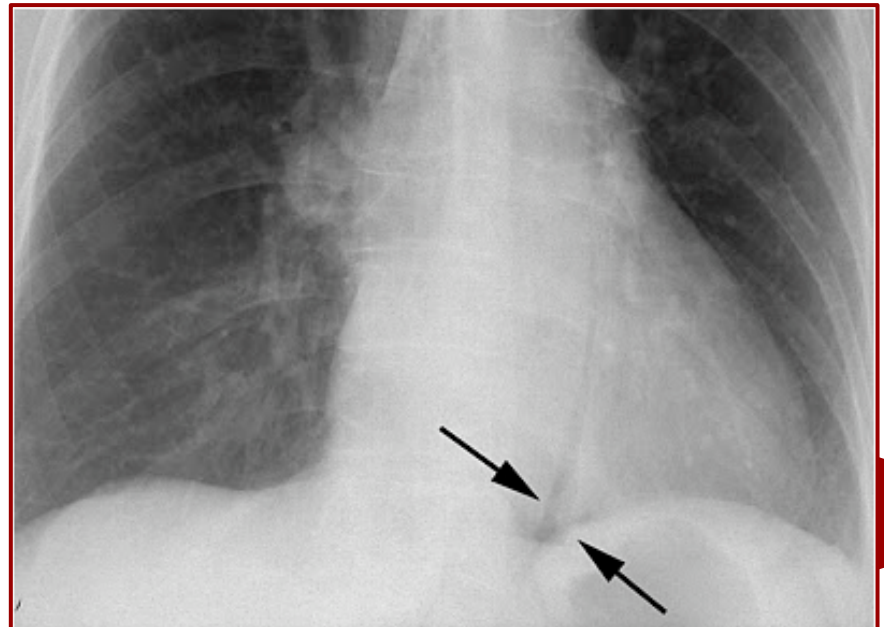
## MOST COMMON

Chest pain  
Fever  
Dyspnea  
Crepitus



# DIAGNOSIS – PLAIN FILMS

- Lateral Neck, CXR
- Suggestive in 90% of esoph perfs
- CAVEAT: timing
  - May be normal up to 1 hour after event
  - Mediastinal Air – 1 hour to evolve
  - Pleural Effusion/Mediastinal Widening – Hours
- Other Findings
  - “V” Sign →
  - Mediastinal air–fluid level
  - Hydropneumothorax

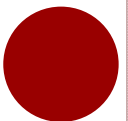


# DIAGNOSIS – GASTROGRAFFIN SWALLOW

- Meglumine Sodium
- Water-soluble contrast
- Benefits
  - Readily absorbed
- Concerns
  - False-negative rate of ~10%
  - Extravasates in only 50% of cervical, 80% of thoracic perfs
  - If aspirated → severe pneumonitis and pulm edema 2/2 hypertonicity



**FIGURE 3.** Gastrografin® swallow evaluation showing extravasation (arrow) from cervical esophagus.



# DIAGNOSIS – BARIUM SWALLOW

- Single (barium) vs Double (air and barium)
- Benefits
  - Better detection than Gastrograffin
  - 60% of cervical and 90% of thoracic perfs
- Concerns
  - Extravasation → fibrosing mediastinitis
  - Long-term presence can complicate future imaging
- Consider thinned barium (often 50% dilution)



## **Esophageal perforation: comparison of use of aqueous and barium-containing contrast media.**

Buecker A, Wein BB, Neuerburg JM, Guenther RW.

Clinic for Diagnostic Radiology, University of Technology Aachen, Germany.

- Prospective study of 67 pts with suspected EP
- All initially examined with aqueous material
- 18 pts – no leak determined
- Of those, 4 (22%) underwent barium esophagram which detected the perforation
- No complications noted with the barium

**TAKE-HOME POINT:**  
A negative gastrograffin does  
not rule-out a perforation



# DOES EVERYONE THINK BARIUM IS TOXIC TO THE MEDIASTINUM?

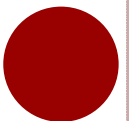
Radiology. 1997 Feb;202(2):360-2.

## **Barium sulfate: a new (old) contrast agent for diagnosis of postoperative esophageal leaks.**

Gollub MJ, Bains MS.

Department of Radiology, Memorial Sloan-Kettering Cancer Center, New York, NY 10021, USA.

- Small study of barium esophagrams post-operative EP
- 12 pts had post-op leak
- No cases of barium interfering with subsequent imaging or causing mediastinitis

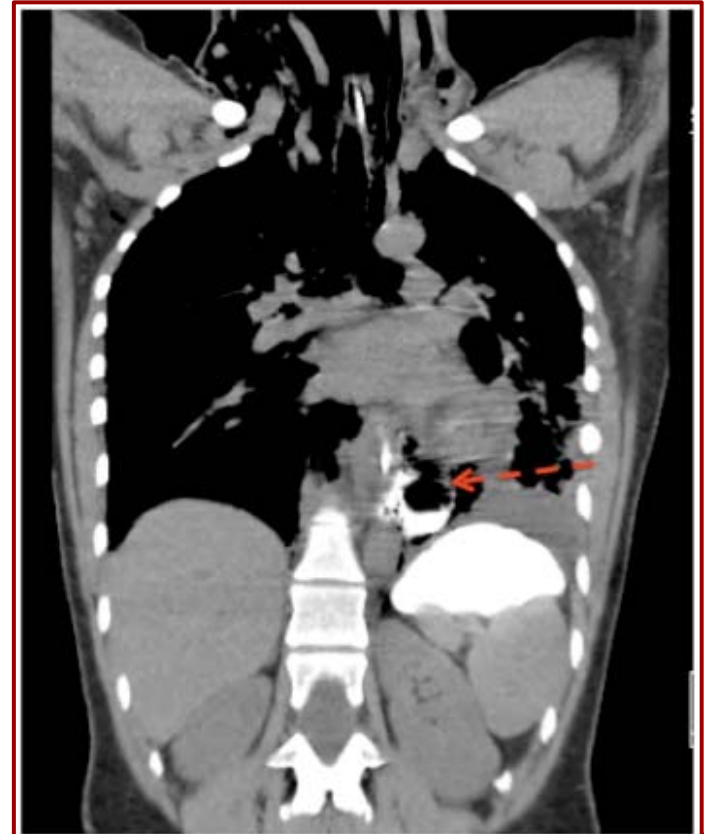


# DIAGNOSIS – CT

- Most-common finding: extraluminal air
- Useful in
  - High clinical suspicion with neg esophagram
  - Pts too unstable for esophagram
  - Atypical symptoms



**FIGURE 2.** CT scan of the neck with dilute Gastrografin® demonstrating periesophageal air leaks (arrowheads) and extravasated contrast (arrow), confirming and localizing esophageal perforation.



**Figure 2** Computer tomography (CT) with an oral contrast swallow, showing distal contrast leakage and gas bubbles in the mediastinum only few hours after pneumatic dilatation for achalasia.



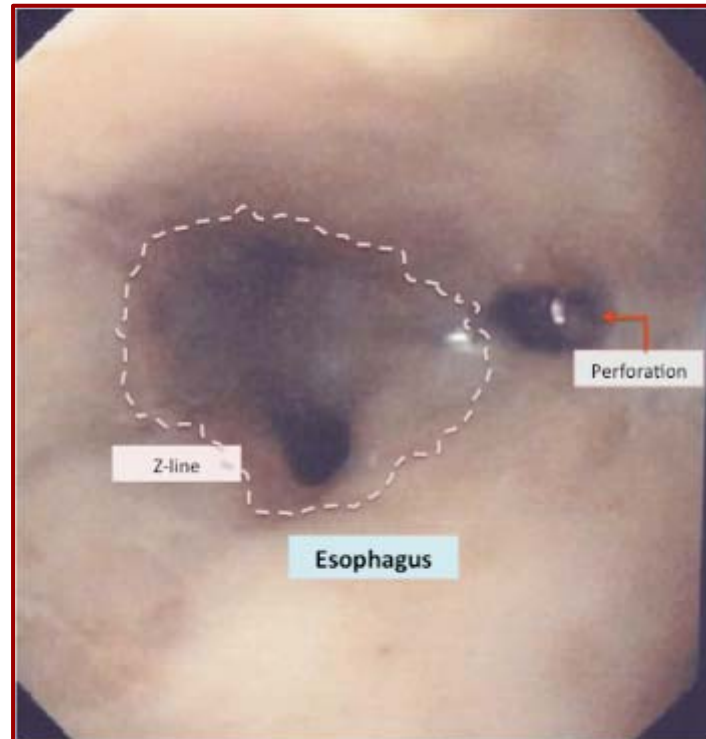
# DIAGNOSIS

## ○ EGD

- Direct visualization – specificity 83%
- May be useful in assessing perforation 2/2 external penetrating trauma
- Otherwise, considered contraindicated when small mucosal/submucosal tears 2/2 air insufflation

## ○ Pleural Fluid

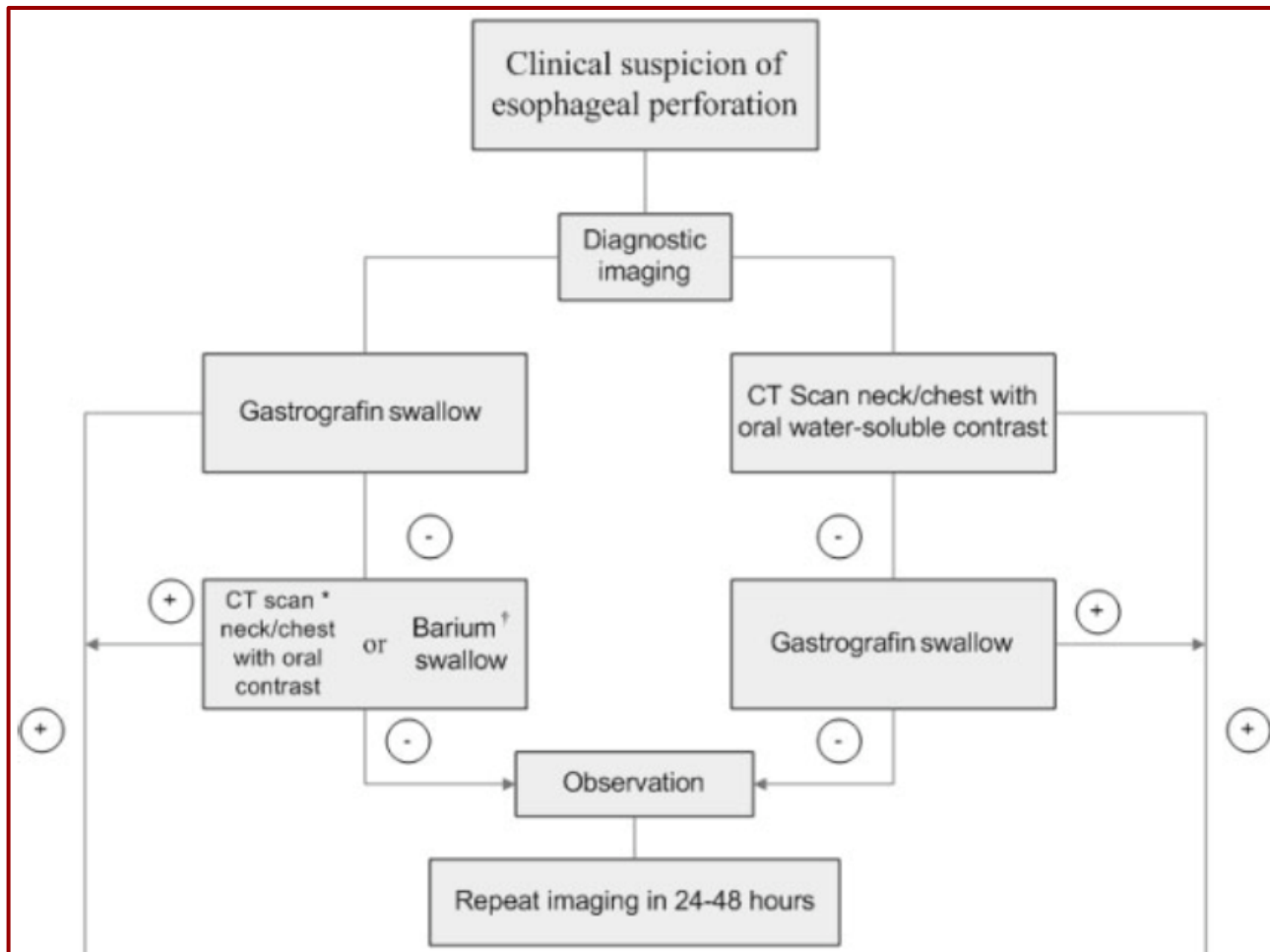
- Undigested food
- $\text{pH} < 6$
- Elevated amylase





# WHAT IS THE BEST DIAGNOSTIC ALGORITHM?

... DEPENDS ON WHO YOU ASK.



- Some surgeons start with barium. If any extrav. → straight to OR
- If your first test negative, try again with a different test

# RISK IS LOW. . . . . . BUT MORTALITY IS HIGH

Table 1. Outcome After Treatment of Esophageal Perforation in Series Published Between 1980 and 1990<sup>a</sup>

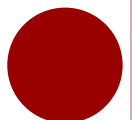
Reference	Year	Primary Repair	Drainage	Resection	Exclusion and Diversion	Nonoperative	Overall Mortality <sup>b</sup>
Skinner et al [47]	1980	0/15	4/8	3/9	2/11	. . .	9/43 (21)
Goldstein and Thompson [112]	1982	4/23	. . .	. . .	6/9	4/12	14/44 (32)
Sarr et al [45]	1982	0/15 <sup>c</sup>	0/13	3/8	0/3	1/8	4/47 (9)
Larsen et al [23]	1983	10/47	4/8	. . .	. . .	0/2	14/57 (25)
Ajalat and Mulder [111]	1984	0/12	1/5	0/1	1/2	3/13	5/33 (15)
Borgeskov et al [53]	1984	9/22	3/7	2/2	. . .	5/8	19/39 (49)
Radmark et al [52]	1986	1/17 <sup>d</sup>	. . .	0/2	1/2	5/17	7/38 (18)
Brewer et al [71]	1986	9/53	0/6	0/2	0/2	0/15	9/78 (12)
Nesbitt and Sawyers [55]	1987	3/20	3/4	. . .	1/8	1/2	8/34 (24)
Moghissi and Pender [67]	1988	7/13 <sup>c</sup>	4/5	2/11	. . .	. . .	13/29 (45)
Flynn et al [113]	1989	1/44	2/9	1/4	1/2	0/8	5/67 (7)
Gouge et al [50]	1989	0/14	0/1	1/1	2/2	. . .	3/18 (17)
Attar et al [51]	1990	5/30	7/17	2/9	4/5	. . .	18/61 (30)
Total		49/325	28/83	14/49	18/46	19/85	128/589
Mortality (%)		15	34	29	39	22	22

# FACTORS AFFECTING MORTALITY

Etiology	
Spontaneous	36 %
Iatrogenic	19%
Traumatic	7%
Location	
Cervical	6%
Thoracic	27%
Abdominal	21%
Time to Diagnosis	
< 24 hours	14%
> 24 hours	27%

Etiology:  
1980 – 1990 data

Location &  
Time to Dx:  
1990–2003 data



# TREATMENT

## ◦ At First Suspicion

- ICU
- NPO
- IVF
- Broad-spectrum antibiotics
  - May add antifungals in select cases

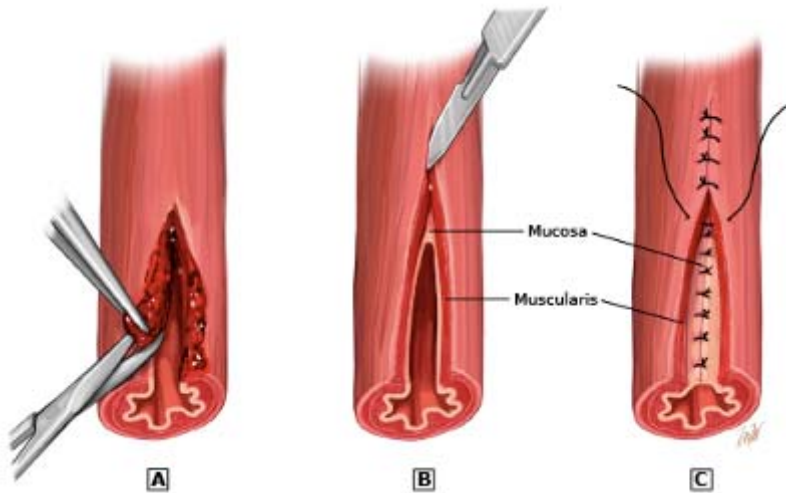
## ◦ Goals

- Prevention of further contamination
- Elimination of infection
- Restore integrity of GI tract
- Establishment of nutritional support

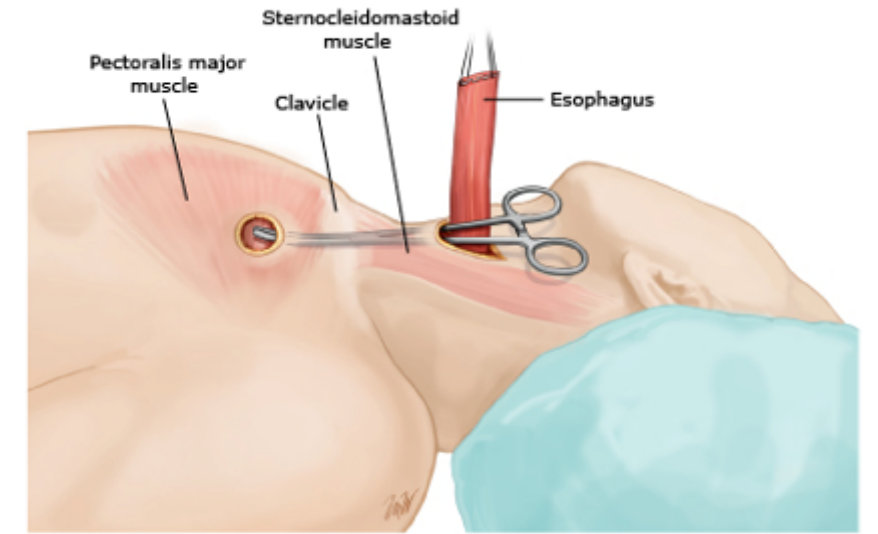


# SURGICAL MANAGEMENT

## 1) Primary Repair



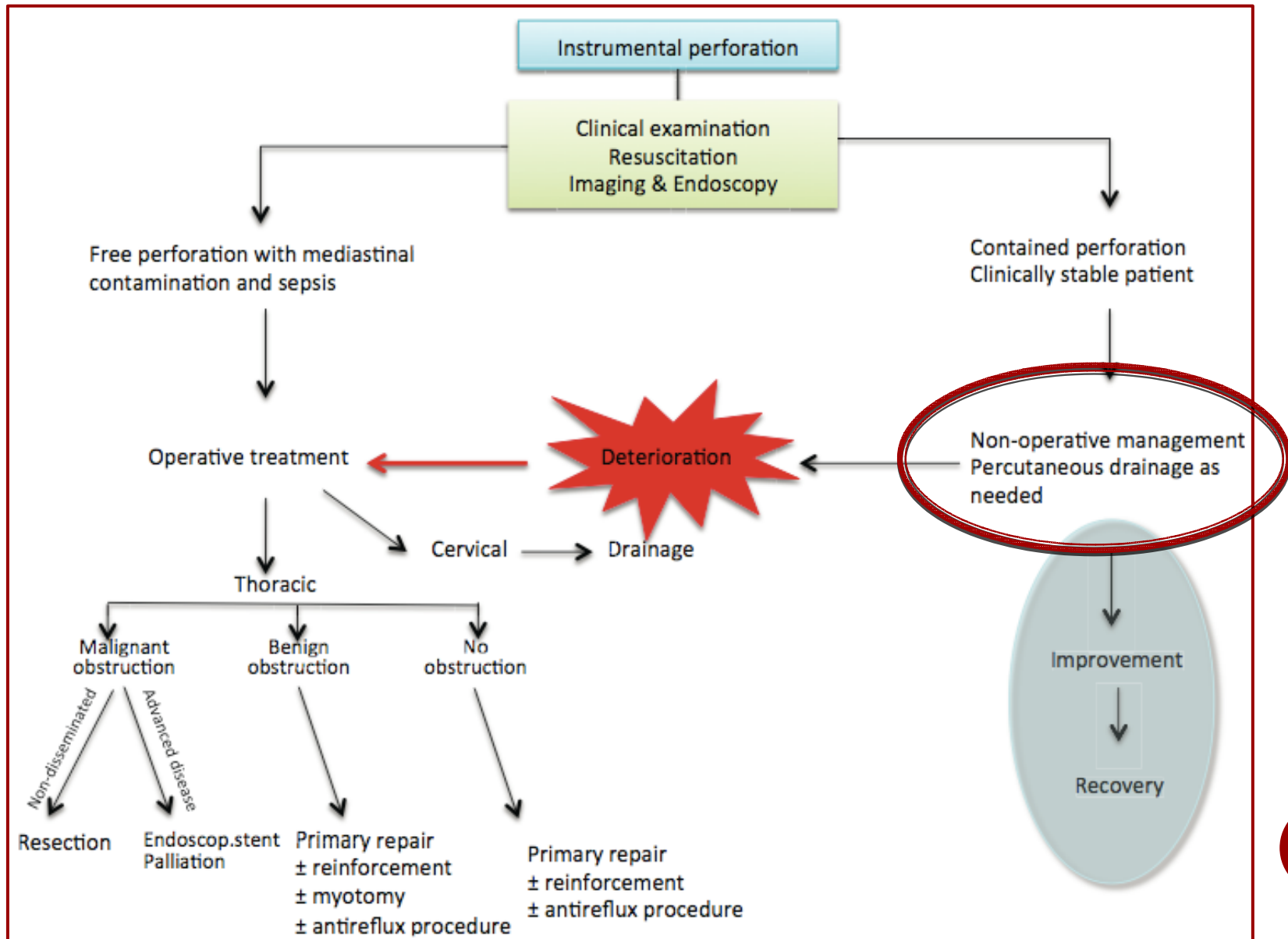
## 2) Diversion



## 3) Esophagectomy

## 4) Drainage Only

# MANAGEMENT



# MANAGEMENT

- The role of non-operative management has evolved rapidly recently
  - Increased incidence of iatrogenic perfs – diagnosed quicker and less contamination
- Minimally Invasive Repairs
  - Esophageal Stenting (off-label use of stent)
  - Esophageal Clipping
  - VATS
- There are NO accepted guidelines on this
- CAREFUL PATIENT SELECTION





# ESOPHAGEAL STENTING

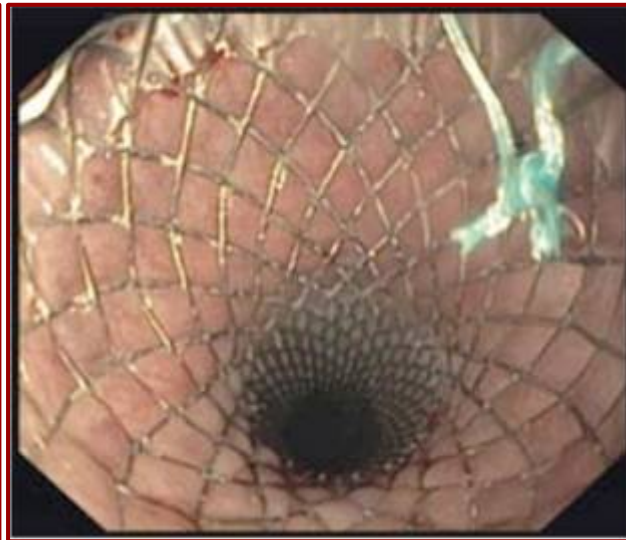
TEAR



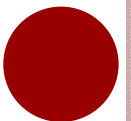
STENT



HEAL



(partially covered metal stent)





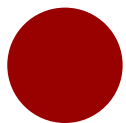
## A management algorithm for esophageal perforation

Jon Kiev, M.D.\*, Michael Amendola, M.D., Doumit Bouhaidar, M.D.,  
Bimaljit S. Sandhu, M.D., Xian Zhao, James Maher, M.D.

*Division of Cardiothoracic Surgery, Virginia Commonwealth University Medical Center, PO Box 980068, Richmond, VA 23298-0068, USA*

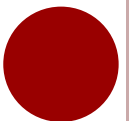
- 2003 – 2005
- 14 pts with esophageal perforation
- Mean age 53
- In all patients, little clinical suspicion for mediastinal spoiling due to no sepsis
- Done in the OR with CT Surgeons

Cause	Number
Pneumatic dilation	2
Transesophageal echo probes	2
Boerhaave's syndrome	2 (5)*
Esophageal cancer	1
Foreign body	1
Gunshot wound	1



# HOW IS IT DONE?

- General Anesthesia
- Endoscope identifies perforation site with minimal air insufflation
- PEG placement
- Polyflex stent placement under flouro
- Repeat endoscopy to confirm esoph and stent luminal patency
  - 3 required balloon dilation for proper seating
  - 2 required repositioning with forceps
  - 1 required perinasal anchoring
- None required surgical repair
  - 1 required thoracoscopy for prev undrained mediastinal collection

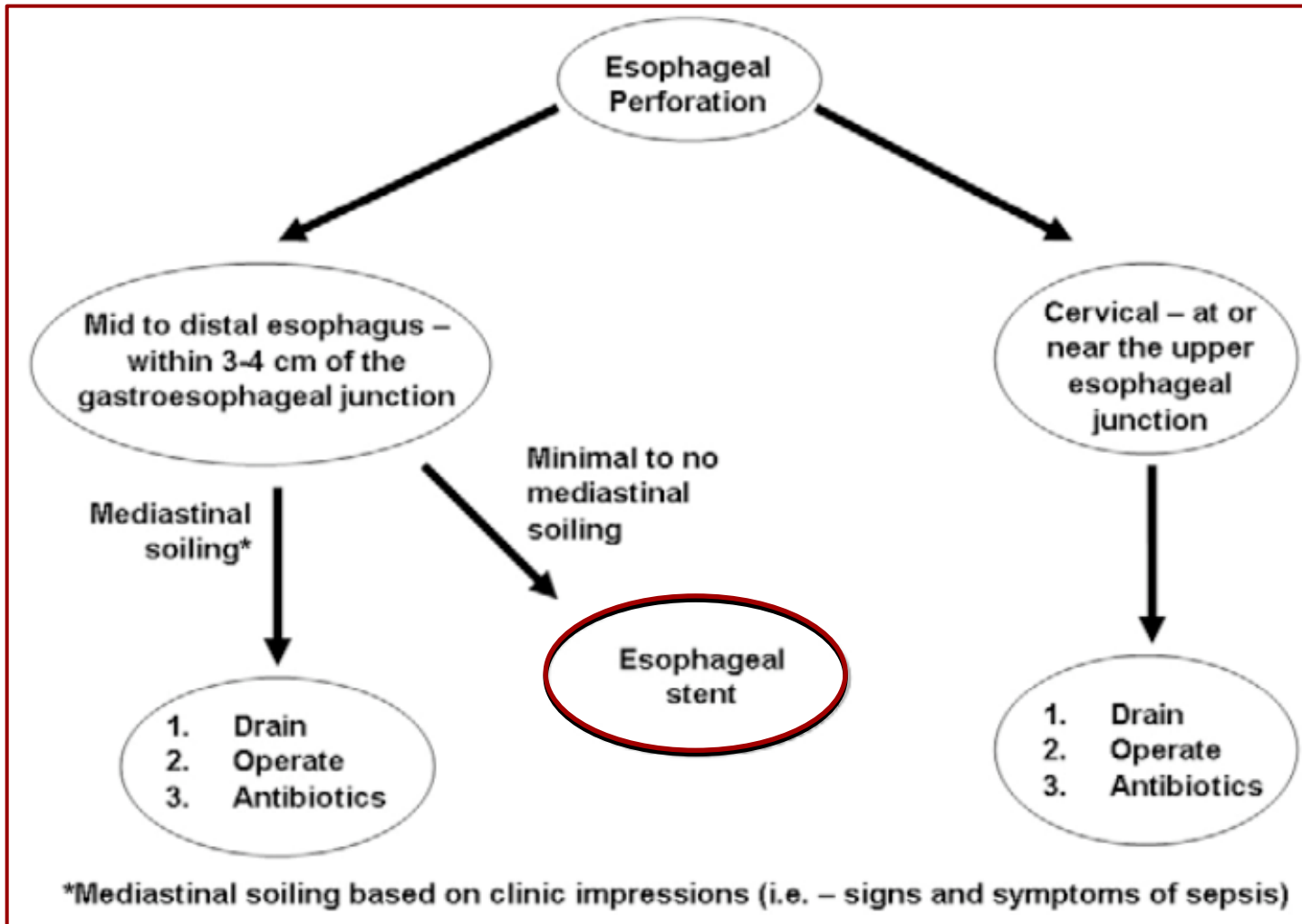


# ESOPHAGEAL STENTING

- All pts tolerated liquids after extubation
- F/U contrast esophagram ~day 5
- Three stents had migrated – days 7/15/16
  - 2 repositioned and then removed ~day 30
  - 1 removed and didn't require repeat placement
- 4 month f/u – all stents removed
- None required PRBC
- Mean hospital stay 12 days
- F/U 12/14 alive
  - 2 died of primary disease – esoph ca
- Complications:

Cause	Number
Pneumonia	5
Stent migration	3
Urinary retention	2
Deep venous thrombosis	1
Dislodged PEG	1

# PROPOSED TREATMENT ALGORITHM



# Esophageal Stent Placement for the Treatment of Iatrogenic Intrathoracic Esophageal Perforation

Richard K. Freeman, MD, Jaclyn M. Van Woerkom, RN, BSN,  
and Anthony J. Ascoti, MD

Department of Thoracic and Cardiovascular Surgery, St. Vincent Hospital, Indianapolis, Indiana

- 17 pts with acute esoph perfs
- Exclusions: esoph malig, chronic fistula, prior surgery
- All leaks documented by esophagram prior to treatment and CT C/A/P
- 11 pts diagnosed with mediastinitis by thoracic surgeon (65%). An additional 4 had s/o sepsis.
- General Anesthesia, Thoracic Surgeon
- PEG in most, Esoph Stent, Drainage of Infected area
- Repeat contrast esoph at at least 48h
- Stents removed after at min 14 days, followed by repeat esophagram

Age (Years)	Initial Procedure	Time to Diagnosis (Hours)
17	Spine (discectomy)	101
28	Spine (discectomy)	86
31	EGD/FB removal	10
39	EGD/dilatation	19
41	Laparoscopic fundoplication	23
45	Reoperative decortication	121
48	EGD/EUS	3
49	EGD/FB removal	4
53	EGD/dilatation	8
58	Laparoscopic paraesophageal hernia repair	64
59	Spine (discectomy)	57
61	Reoperative thoracic aortic aneurysm repair	87
66	Laparoscopic fundoplication	33
71	EGD/biopsy	12
76	Laparoscopic fundoplication	22
83	EGD/FB removal	6
91	EGD/antireflux procedure	6

# IATROGENIC INTRATHORACIC EP

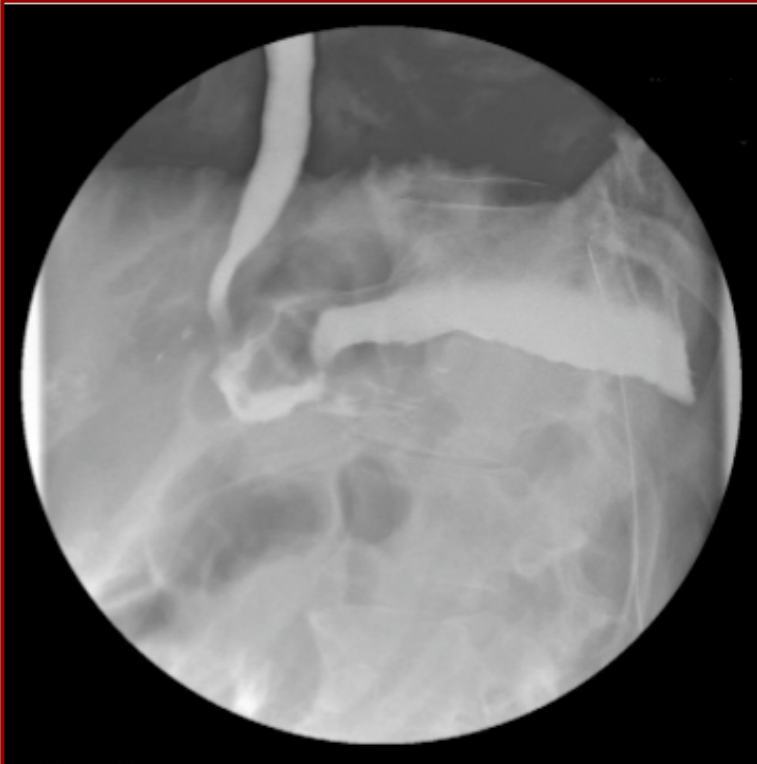


Fig 1. Gastrografin esophagram of a patient displaying a distal, intrathoracic esophageal perforation. The brisk extravasation of contrast can be seen flowing over the dome of the left hemidiaphragm in the pleural space.

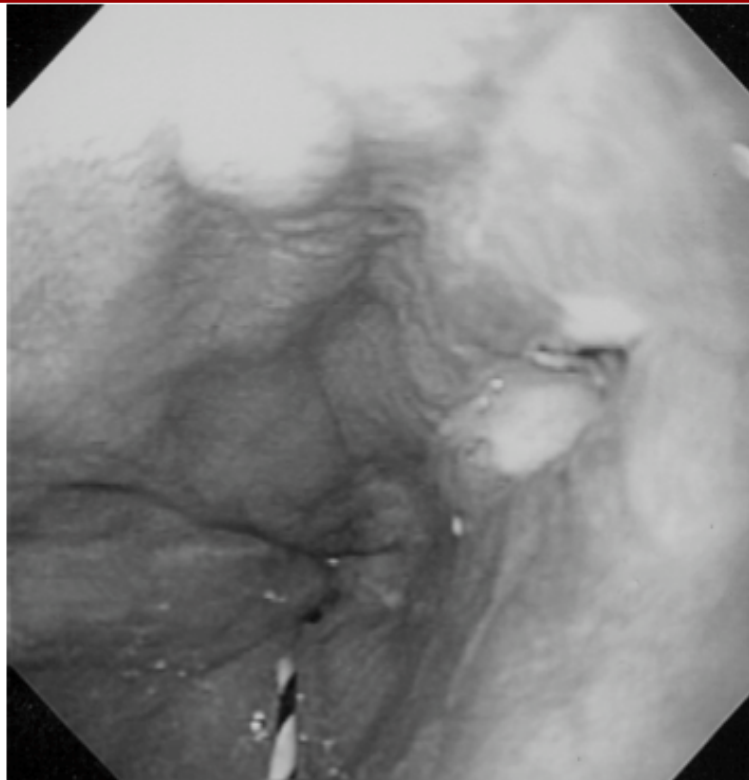
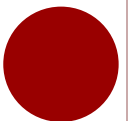


Fig 2. Endoscopic finding displaying the esophageal perforation recognized on esophagram (Fig 1).

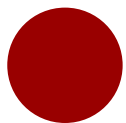


# IATROGENIC INTRATHORACIC EP

- Mean time from perf → stent : 39 hours
- Additional procedures

Associated Endoscopic or Surgical Procedure	Number
Percutaneous endoscopic gastrostomy	12
Endoscopic esophageal dilatation	1
Tube thoracostomy	4
Video-assisted thoracoscopic decortication	2
Celiotomy with gastrostomy and jejunostomy	1

- Repeat esophagram ~3D after stent
  - 16/17 had occlusion of the defect
  - 1 with persistent defect → OR for primary repair 3 days after stent placement
  - 14 were started on diet within 72 hours of stent
- Stent migration/replacement in 3
- Removed in all by ~50 days
- LOS  $8 \pm 9$  days





# ARE GI'S DOING STENTING FOR THESE?

## The Use of a Self-Expandable Plastic Stent for an Iatrogenic Esophageal Perforation

John M. Petersen, DO, FACG, FACP

*Baptist Medical Center, Borland-Groover Clinic,  
Jacksonville, Florida*

### Diagnosis



### 1 mo post-stent removal



- 48F with radiation-induced distal esoph stricture s/p dilation 8 → 13mm
- In recovery, EP diagnosed
- NG endoscopically placed, NPO, IVF, Abx
- Within 24 hours: Polyflex 18mm x 9cm stent attached to prox esoph with clips/nylon ligatures
- Diet w/in 48 hours
- Stent removed 6 wks later



# Esophageal perforation: surgical, endoscopic and medical management strategies

Boris Sepesi, Daniel P. Raymond and Jeffrey H. Peters

**Table 3 Recent publications utilizing stents for the treatment of esophageal perforation**

Authors	Number of patients	Mortality rate (%)
Kiev <i>et al.</i> [9]	14	0
Freeman <i>et al.</i> [10]	17	0
Kim <i>et al.</i> [11]	16	6
Salminen <i>et al.</i> [12*]	32	16
Leers <i>et al.</i> [13*]	31	6

**Table 2 Outcomes of patients with esophageal perforation based on a perforation score (0–18)**

	Clinical score		
	≤2 (n = 44)	3–5 (n = 49)	>5 (n = 26)
Complication rate (%)	53	65	81
Mortality (%)	2	6	27
Length of stay (days)	10	16	28

**Table 1 Esophageal perforation severity score**

Variable	Score (range 1–3)
Age >75 years	1
Tachycardia >100 beats/min	1
Leukocytosis >10 000 WBC/ml	1
Pleural effusion (on CXR or CT)	1
Fever >38.5°C	2
Noncontained leak (on CT or barium swallow)	2
Respiratory compromise (respiratory rate >30, mechanical ventilation)	2
Time to diagnosis >24 h	2
Cancer	3
Hypotension	3
Total potential score	18

# TAKE-HOME POINTS

- Know Risk Factors for Esophageal Perfs
  - Interventions: endoscopy, tee, intubation, NGs. . .
  - Spontaneous, foreign bodies, trauma
- Signs are varied, chest pain common
- A Negative Gastrograffin does not r/o EP
- Neither does a negative Barium Swallow
- High Mortality – Don't Miss the Dx
- Know immediate goals of management
- And don't forget to call Risk Management

