

# More Than One Way To Cook the Goose!

## Surgical Management of Esophageal Carcinoma

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# Presenter disclosure

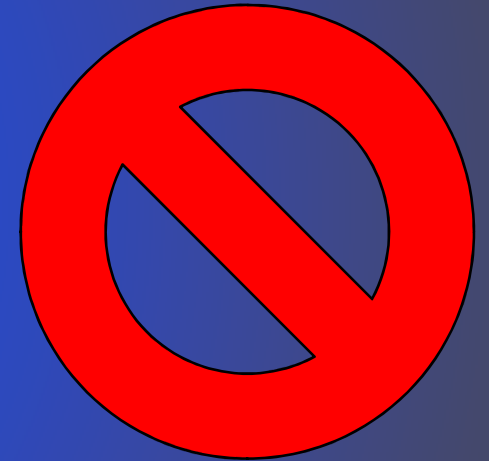
- No conflicts to disclose

# Learning Objectives

- List indications for surgical resection for esophageal carcinoma
- Recognize different surgical approaches for esophagectomy
- Describe common complications following esophagectomy
- Name indications for endoscopic stenting for esophageal carcinoma

# Things you don't mess around with...

- Early childhood: electrical outlets, sharp pointy things



- Adulthood: junior mining stocks, undercooked meat in tropical countries...

# Surgeons: don't mess with the "esopha- goose!"



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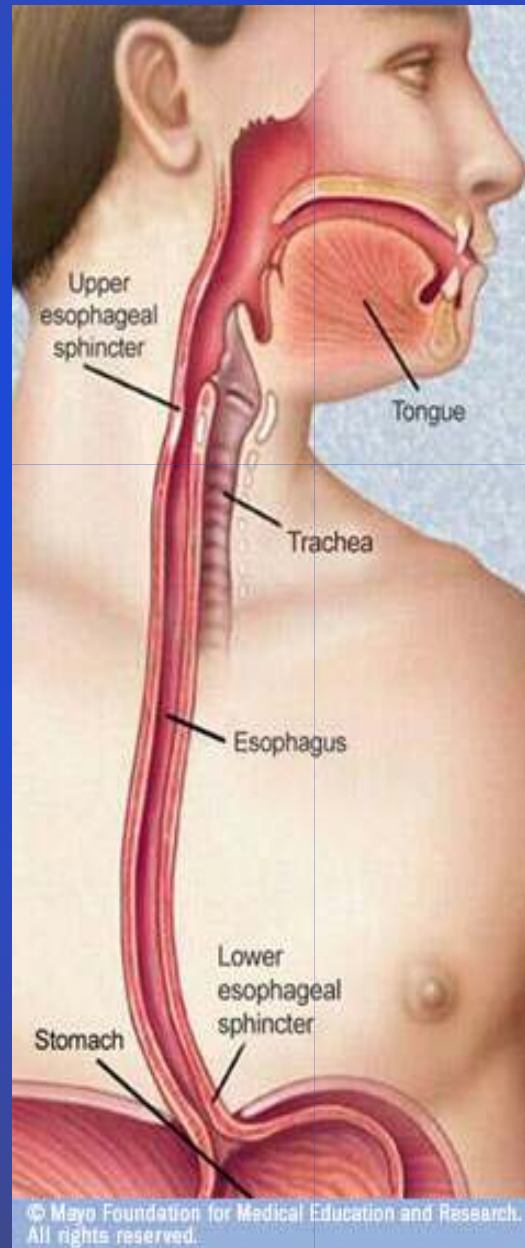
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# 4 Birds of the Thorax

- Esopha-GOOSE
- Va-GOOSE nerve
- Azy-GOOSE vein
- Thoracic DUCK



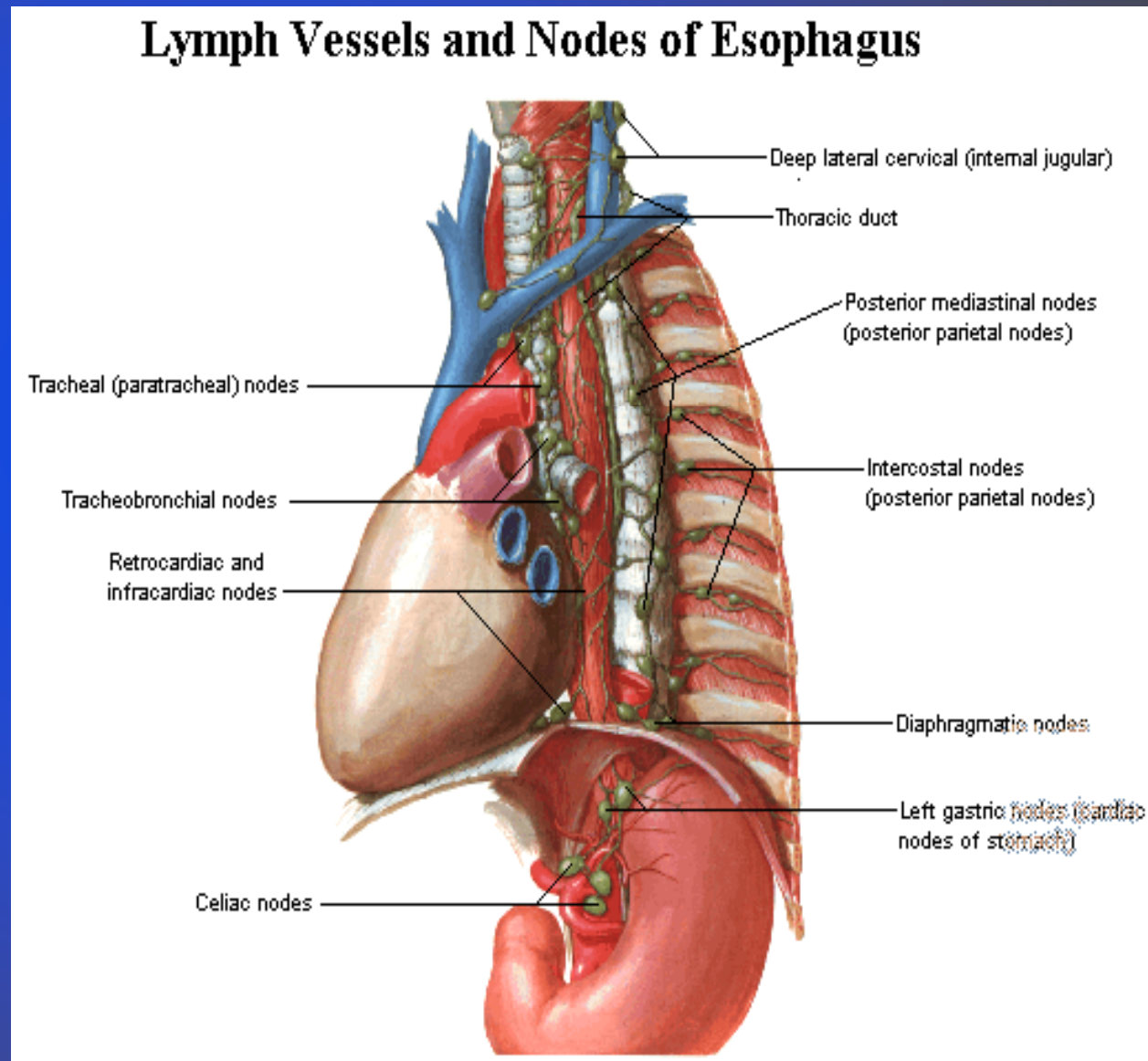
# What makes the esophagus so difficult for surgeons?



# Esophageal Anatomy – *No Man's Land*

-situated in posterior mediastinum: behind heart and trachea, anterior to vertebral bodies

-well protected, but difficult to access!!





# Esophagus not very robust!

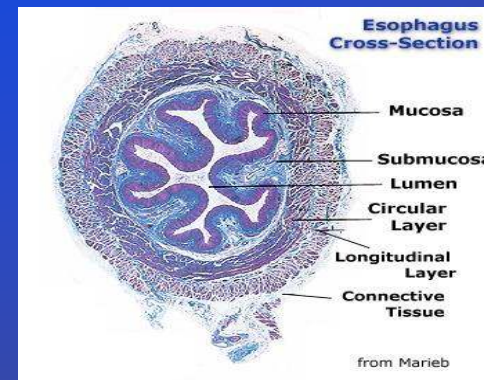
- unlike rest of GI tract, esophagus has no serosa

→ sutures don't hold, more susceptible to leak / perforation @ anastomosis following surgical resection

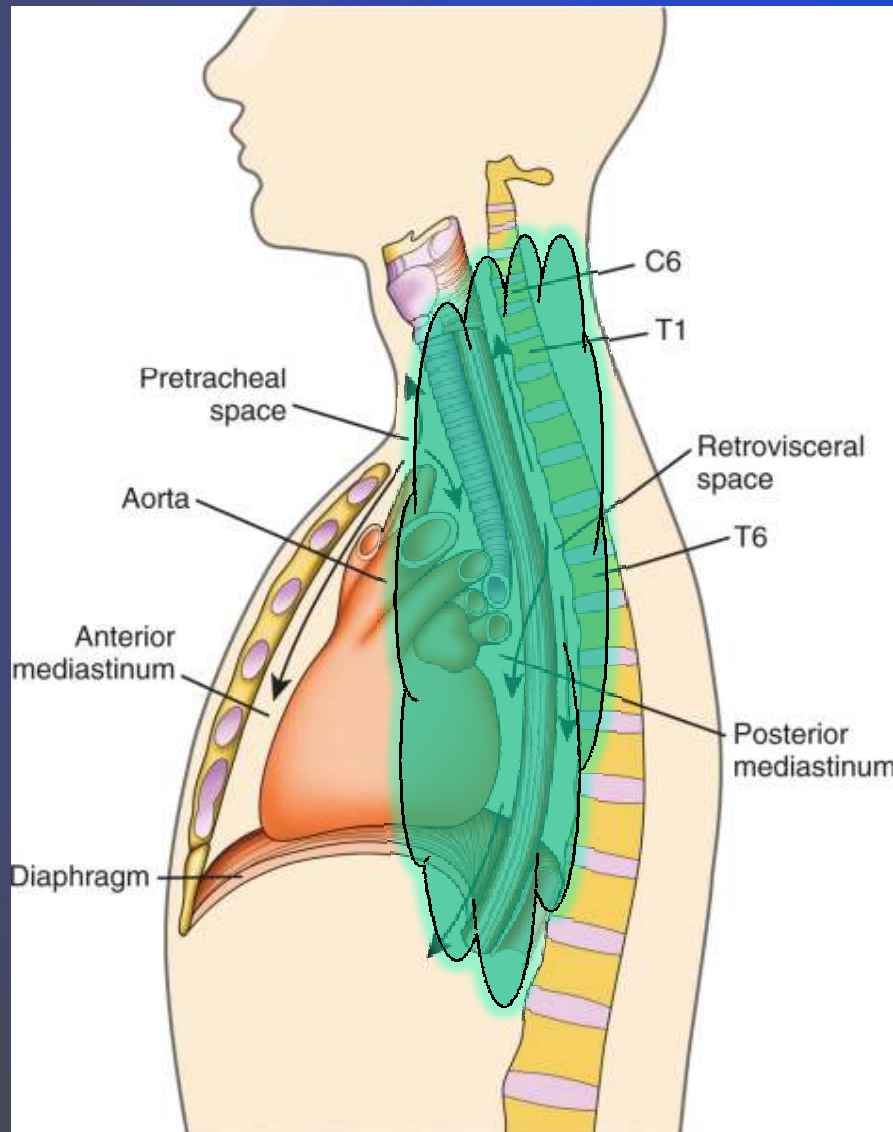
Small intestine – serosa!



Esophagus – no serosa!



# Esophageal leak → mediastinitis → bad...

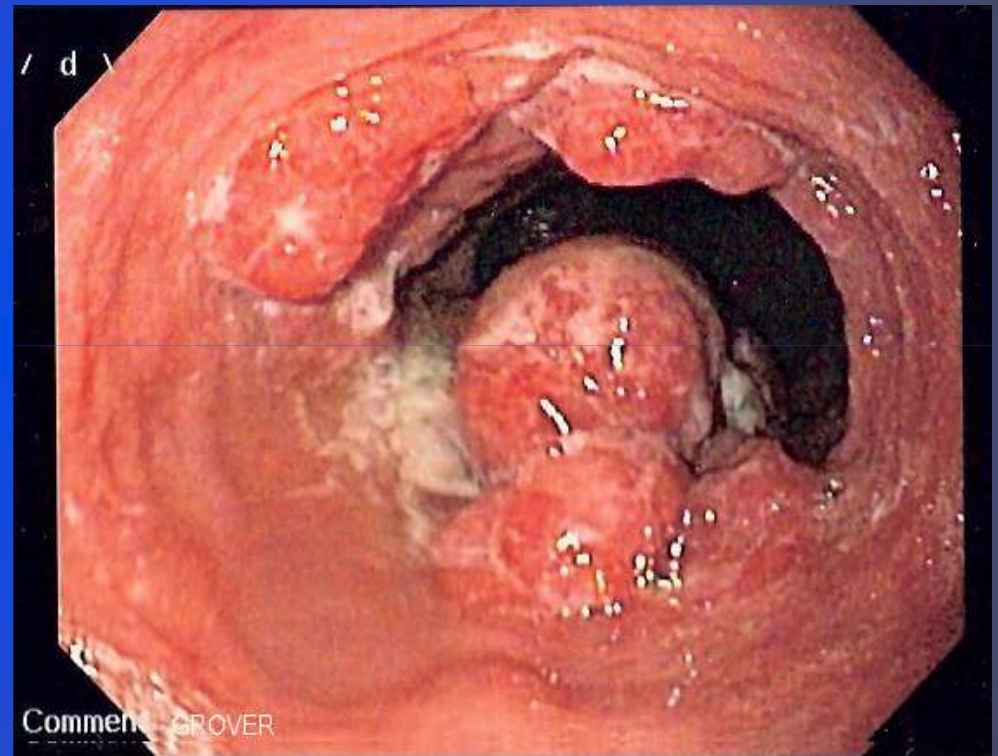


Negative intrathoracic pressure...

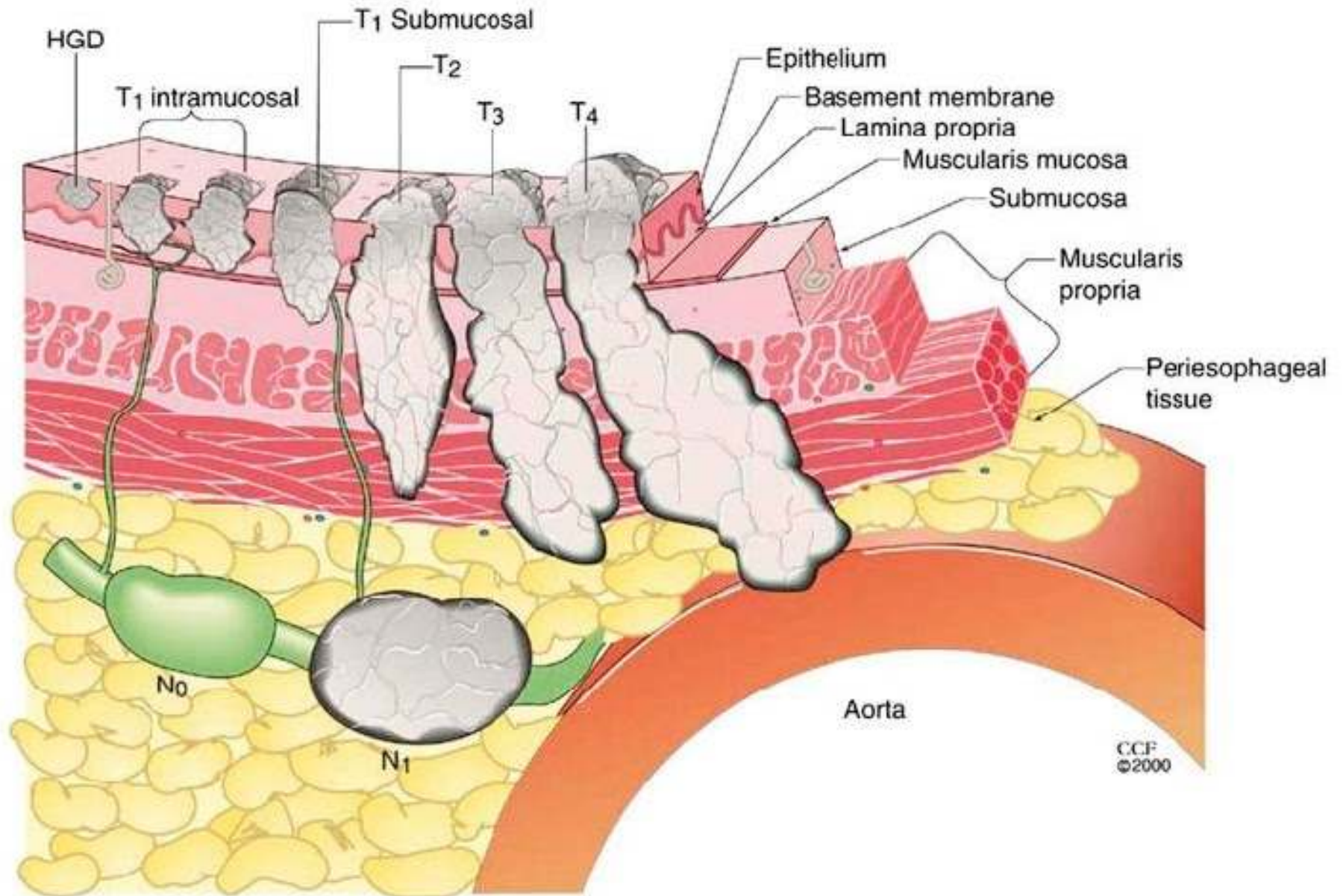
→ rapid dissemination  
low pH, polymicrobial  
fluid into mediastinum,  
pleura → systemic inflam  
response, septic shock,  
multiorgan failure

# Esophageal Cancer

- 6<sup>th</sup> most common cause cancer-related death in Canada (males)
- 2013: 2000 Cdns diagnosed esophageal ca, 1900 died
- 6-fold increase incidence esophageal adenocarcinoma over past 3 decades



# T and N



Table

**New WECC / AJCC Staging System for Esophageal Cancer****TNM Classifications**

## Grade

|    |                           |
|----|---------------------------|
| GX | Grade cannot be assessed  |
| G1 | Well differentiated       |
| G2 | Moderately differentiated |
| G3 | Poorly differentiated     |
| G4 | Undifferentiated          |

## T stage

|     |   |
|-----|---|
| TX  | Primary tumor cannot be assessed                    |
| T0  | No evidence of primary tumor                        |
| Tis | High-grade dysplasia                                |
| T1a | Tumor invading lamina propria or muscularis mucosae |
| T1b | Tumor invading submucosa                            |
| T2  | Tumor invading muscularis propria                   |
| T3  | Tumor invading adventitia                           |
| T4a | Tumor invading pleura, pericardium, or diaphragm    |
| T4b | Tumor invading other adjacent structures            |

## N stage

|    |   |
|----|---|
| NX | Regional lymph nodes cannot be assessed                               |
| N0 | No regional lymph node metastasis                                     |
| N1 | Regional lymph node metastasis involving 1-2 nodes <sup>a</sup>       |
| N2 | Regional lymph node metastasis involving 3-6 nodes <sup>a</sup>       |
| N3 | Regional lymph node metastasis involving 7 or more nodes <sup>a</sup> |

## M stage

|    |   |
|----|---|
| MX | Distant metastasis cannot be assessed                   |
| M0 | No distant metastasis                                   |
| M1 | Nonregional lymph node metastasis or distant metastasis |

**Stage Classifications**

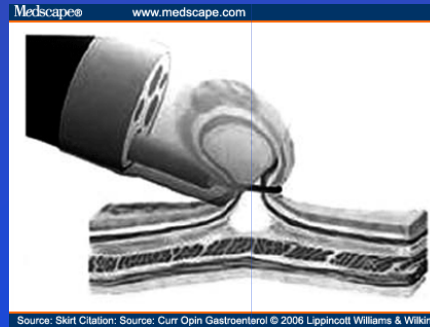
|            |   |
|------------|---|
| Stage 0    | T0 N0 M0, any grade<br>Tis N0 M0, any grade                                 |
| Stage IA   | T1 N0 M0, grade 1-2   |
| Stage IB   | T1 N0 M0, grade 3-4<br>T2 N0 M0, grade 1-2                                  |
| Stage IIA  | T2 N0 M0, grade 3-4   |
| Stage IIB  | T3 N0 M0<br>T0-2 N1 M0, any grade   |
| Stage IIIA | T0-2 N2 M0, any grade<br>T3 N1 M0, any grade<br>T4a N0 M0, any grade        |
| Stage IIIB | T3 N2 M0, any grade   |
| Stage IIIC | T4a N1-2 M0, any grade<br>T4b any N M0, any grade<br>Any T N3 M0, any grade |
| Stage IV   | Any T, any N, M1, any grade   |

<sup>a</sup>Regional lymph nodes extend from periesophageal cervical to celiac nodes.

WECC = World Esophageal Cancer Consortium; AJCC = American Joint Committee on Cancer;  
T = Tumor; N= Node; M = Metastasis.

# Esophageal sparing techniques – high grade dysplasia / intramucosal carcinoma

Endoscopic mucosal resection (EMR)



Radiofrequency ablation (RFA)

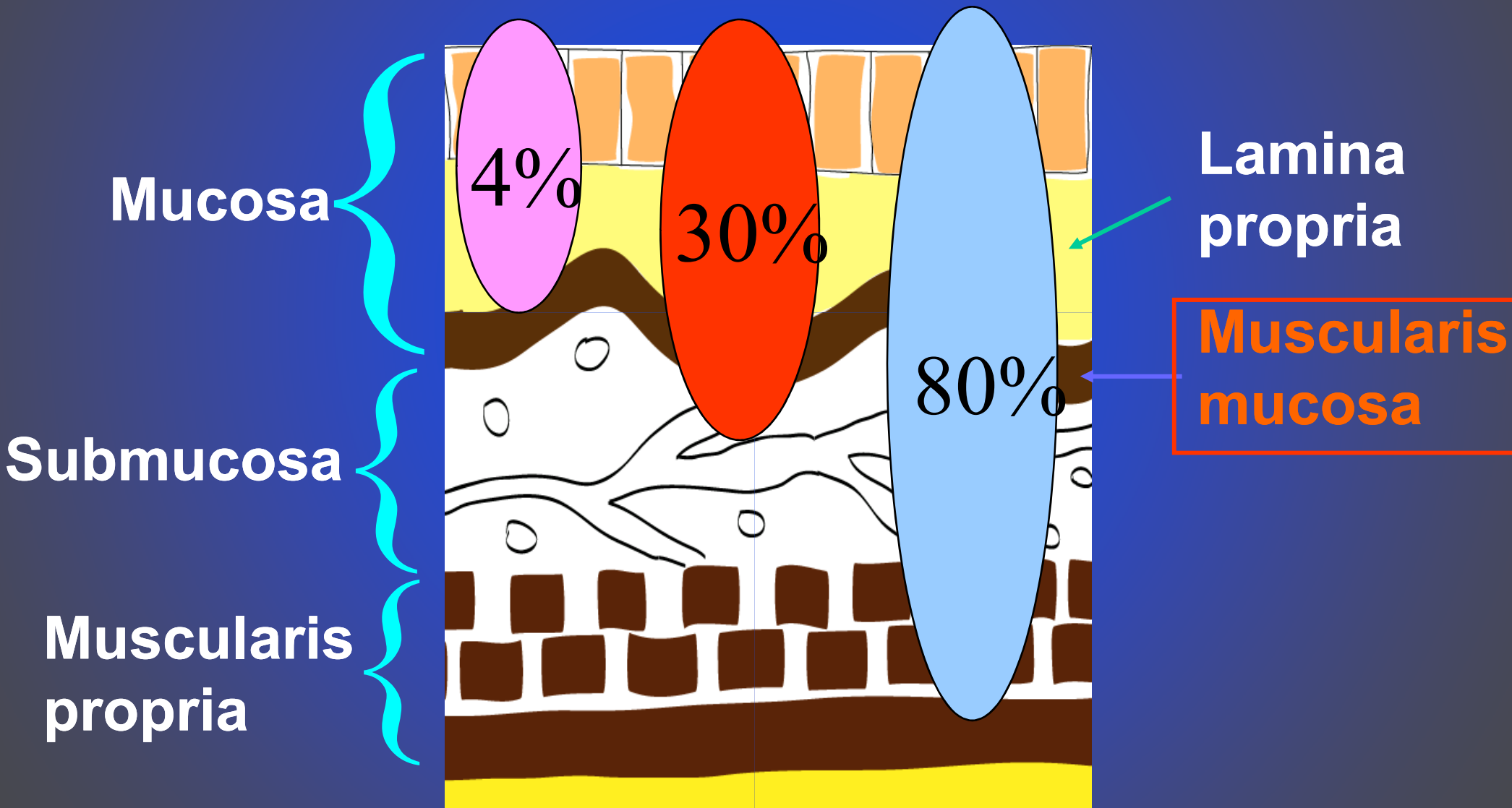


Photodynamic therapy

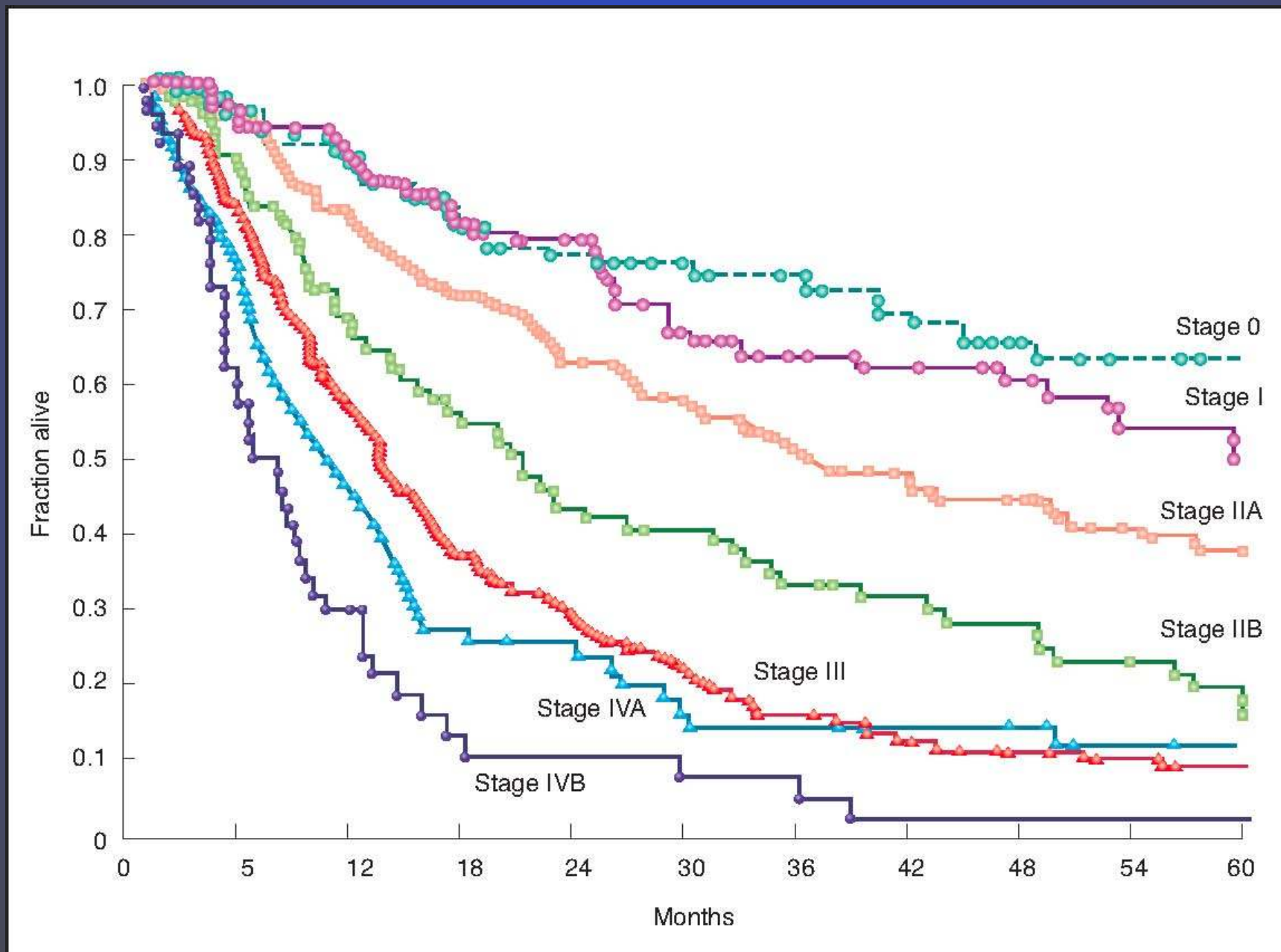


# Esophageal Adenocarcinoma

The relationship between depth of invasion and node metastases



# Survival by Stage – Esophageal Ca





# Treatment for Locally Advanced, Resectable Esophageal Carcinoma

- Majority of centers – multimodality approach including surgery, chemotherapy, radiation
- 2 most common approaches:
  - Neoadjuvant (preop) chemo → surgery (± post-op chemo)
  - Neoadjuvant chemoradiation → surgery

# Algorithm for Esophageal Cancer: HSC Thoracic Wpg

Upper endoscopy, CT, PET, +/- EUS

Unresectable or Metastases



Palliative chemo/XRT

T1N0  
T2-T3  
N+



Esophagectomy

Chemo +/- XRT, esophagectomy

Chemo +/- XRT, esophagectomy

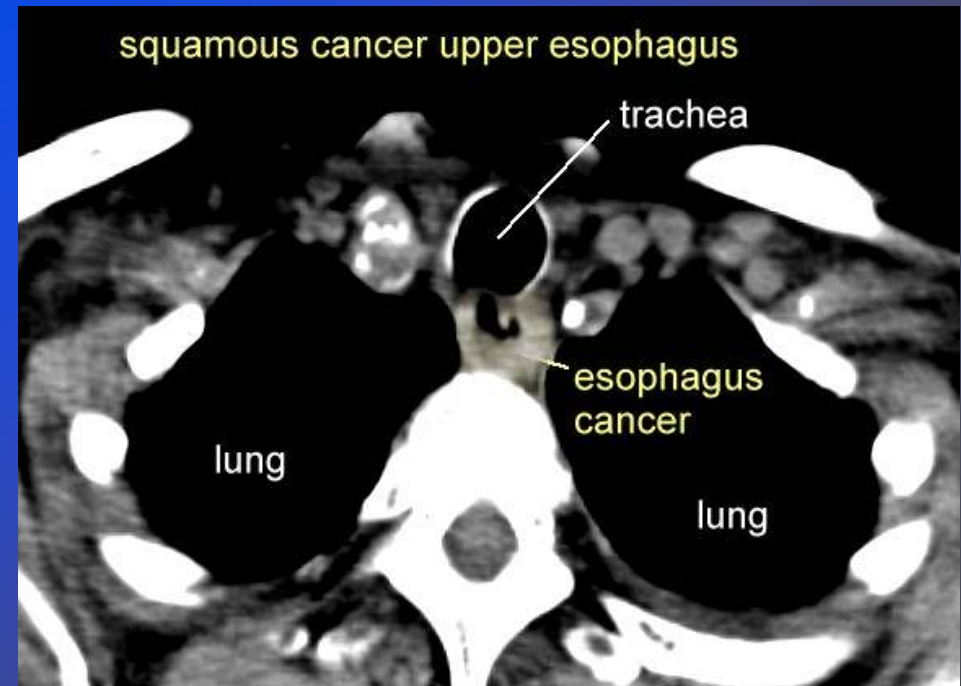
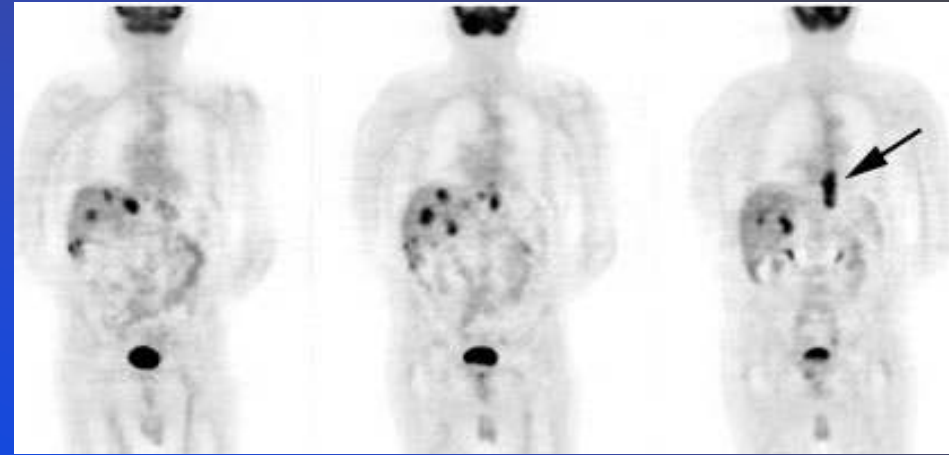
# Should your patient have esophagectomy?

– 2 main considerations

- Is tumor resectable?
- Is patient operable?

## *Unresectable:*

- Distant mets (lung, liver, peritoneal)
- Local invasion major structures (aorta, trachea, heart, spine)



*Inoperable:*

-Elderly

-Comorbidities (cardiac, pulmonary, vasculopath, renal)

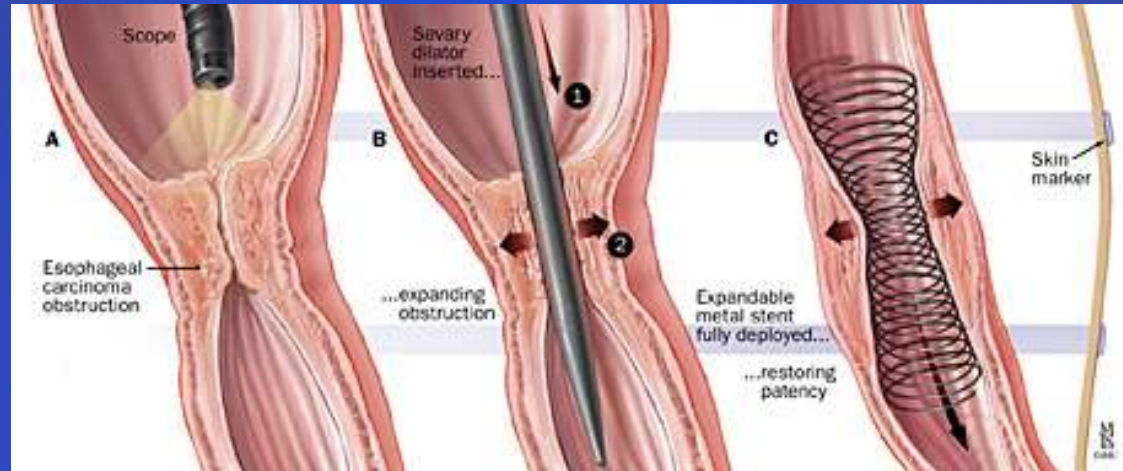


# Esophageal stent for unresectable / inoperable esophageal ca

- For palliation dysphagia
- Self expandable metal or polymer stent, usually partially covered with silicone / polymer coating to prevent tissue ingrowth
- Ambulatory procedure
- Deployed endoscopically +/- fluoroscopy



# Esophageal stent for unresectable / inoperable esophageal ca



# Esophageal stent complications

- Pain, GERD, globus sensation
- Bleed / erosion
- Perforation – but covered stent often adequate to seal leak

\*\*Migration

\*\*Blockage – food, tumor ingrowth





# Esophagectomy for cancer

- The choice of the appropriate technique for esophagectomy depends on many factors
  - Tumor location
  - stage of disease
  - the risk profile of patient
  - the route through which the replacement conduit is to be placed
  - extent of lymphadenectomy
  
- \*\*\* the experience and preference of the surgeon

# Esophagectomy & Mortality

Esophagectomy mortality rates range from 8% at high volume centers to 23% in low volume centers (*NEJM 2002*)

Published series from experienced centers report a mortality rate of 5%

# High Volume Centers for Esophagectomy: Number needed to achieve low post-operative mortality

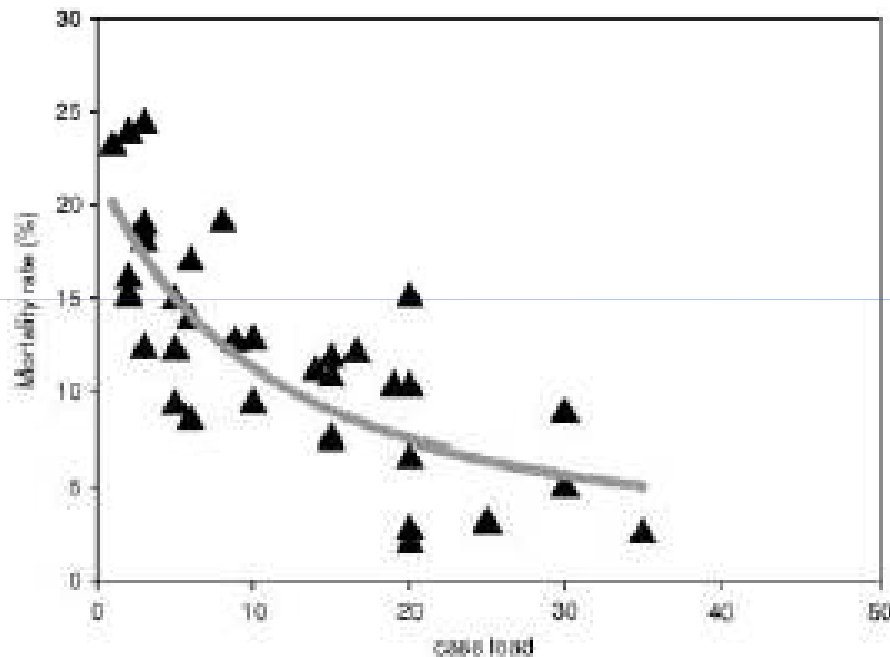
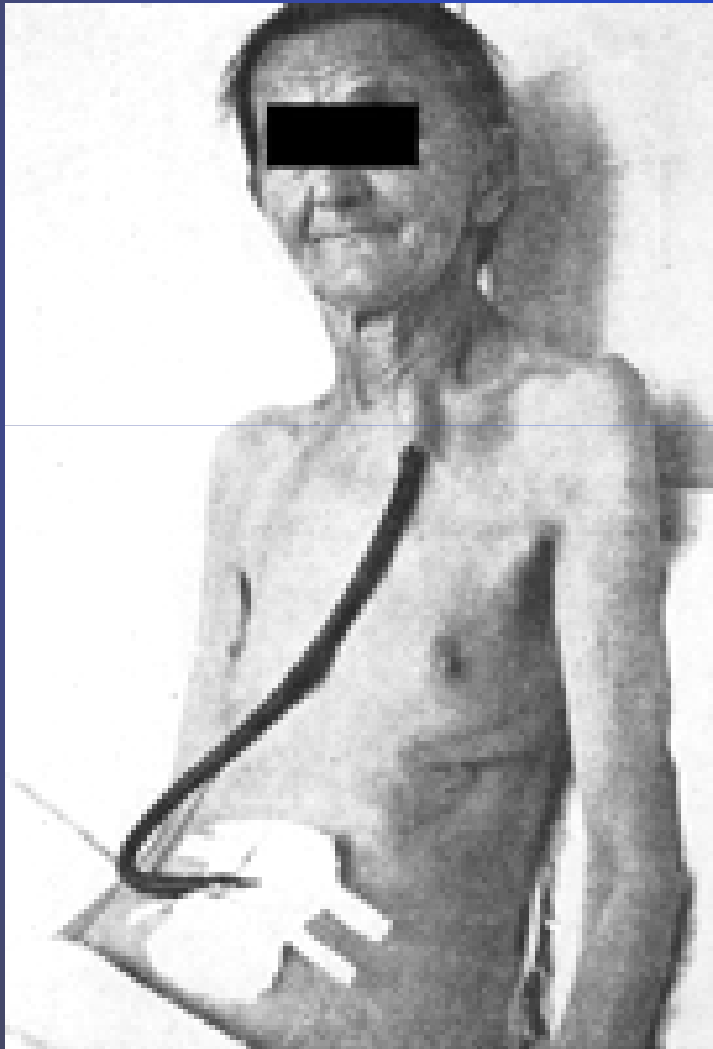


Fig. 2 Correlation between number of esophagectomies and hospital mortality rate.

- Management of complications is more successful in high-volume hospitals
- Long-term prognosis is also correlated to case-volume
- With the experience of > 20 esophagectomies/yr mortality <5% can be achieved

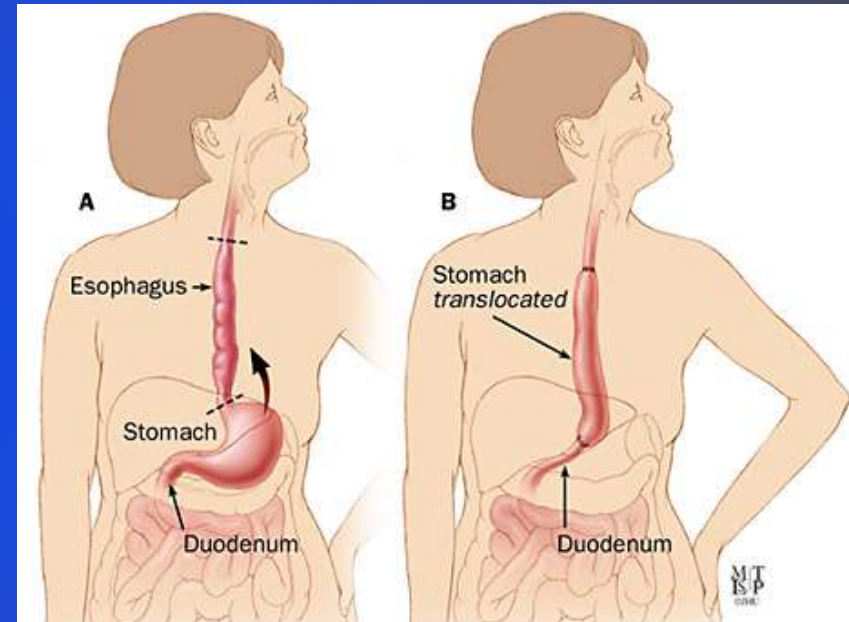


Torek – 1913 – first successful resection thoracic esophageal carcinoma

Lived 13 years without recurrence!

# Goals of an oncologic esophagectomy

- Widely remove all tumor with envelope of normal surrounding tissue – microscopically clear margins
- Remove all locoregional lymph nodes for staging, possible therapeutic effect
- Restore intestinal continuity - esophagus replaced with intestinal conduit – usually stomach (may also use colon, jejunum)
- Minimize operative morbidity

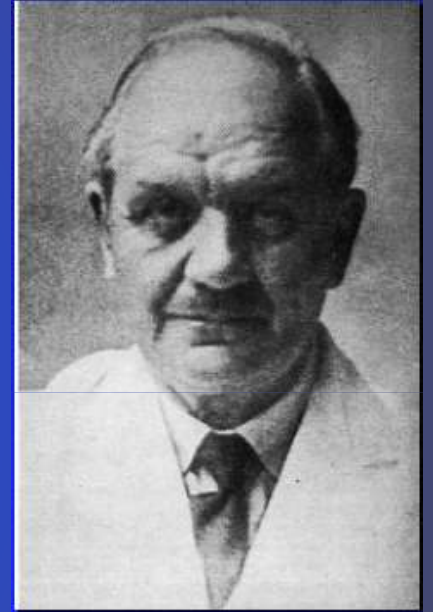


# Takin' out the Goose - Many Options!!

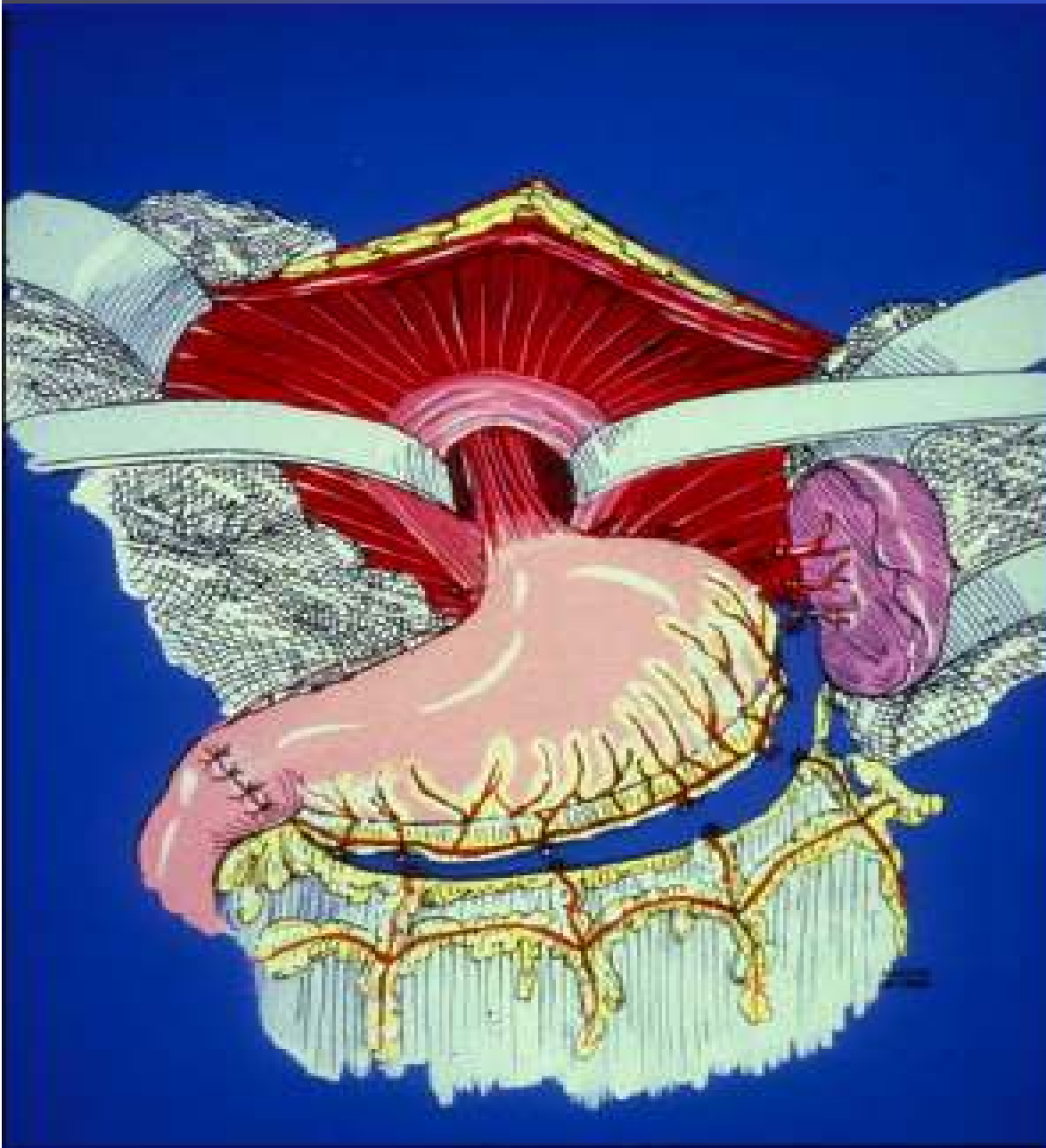


# Ivor Lewis esophagectomy: abdominal + right chest incision

- Ivor Lewis – Hunterian Lecture,  
Royal College Surgeons of  
London      Jan 10, 1946



# Ivor Lewis – Stage 1: Laparotomy

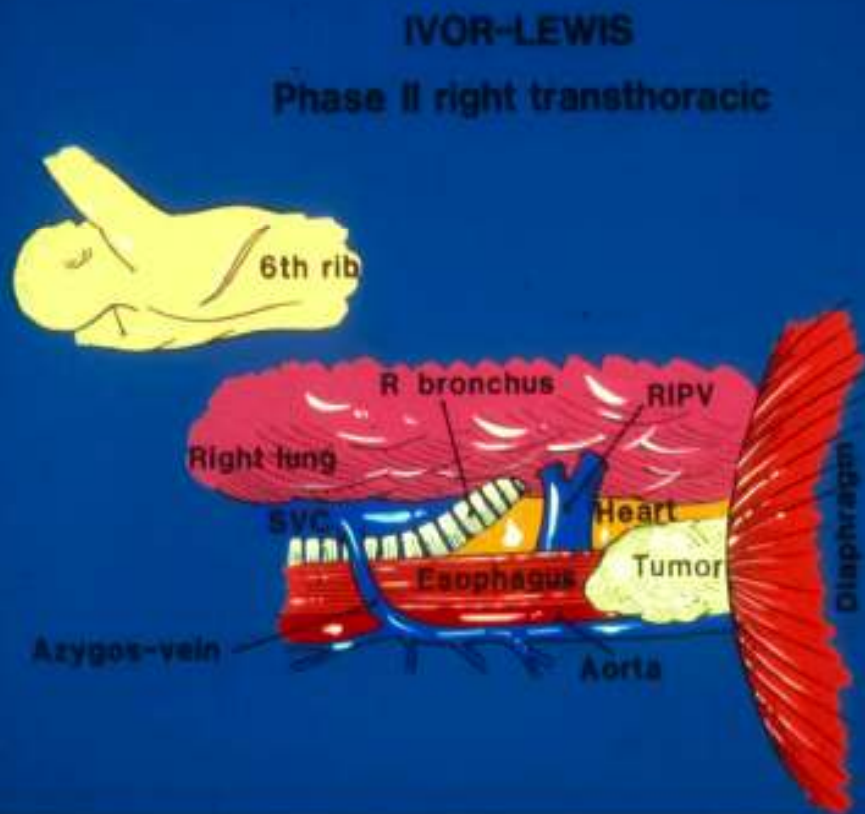


- Mobilization stomach
- Preservation R gastroepiploic artery
- +/- Pyloromyotomy / pyloroplasty – to aid gastric emptying
- Hiatus enlarged
- +/- J- tube (feeding)

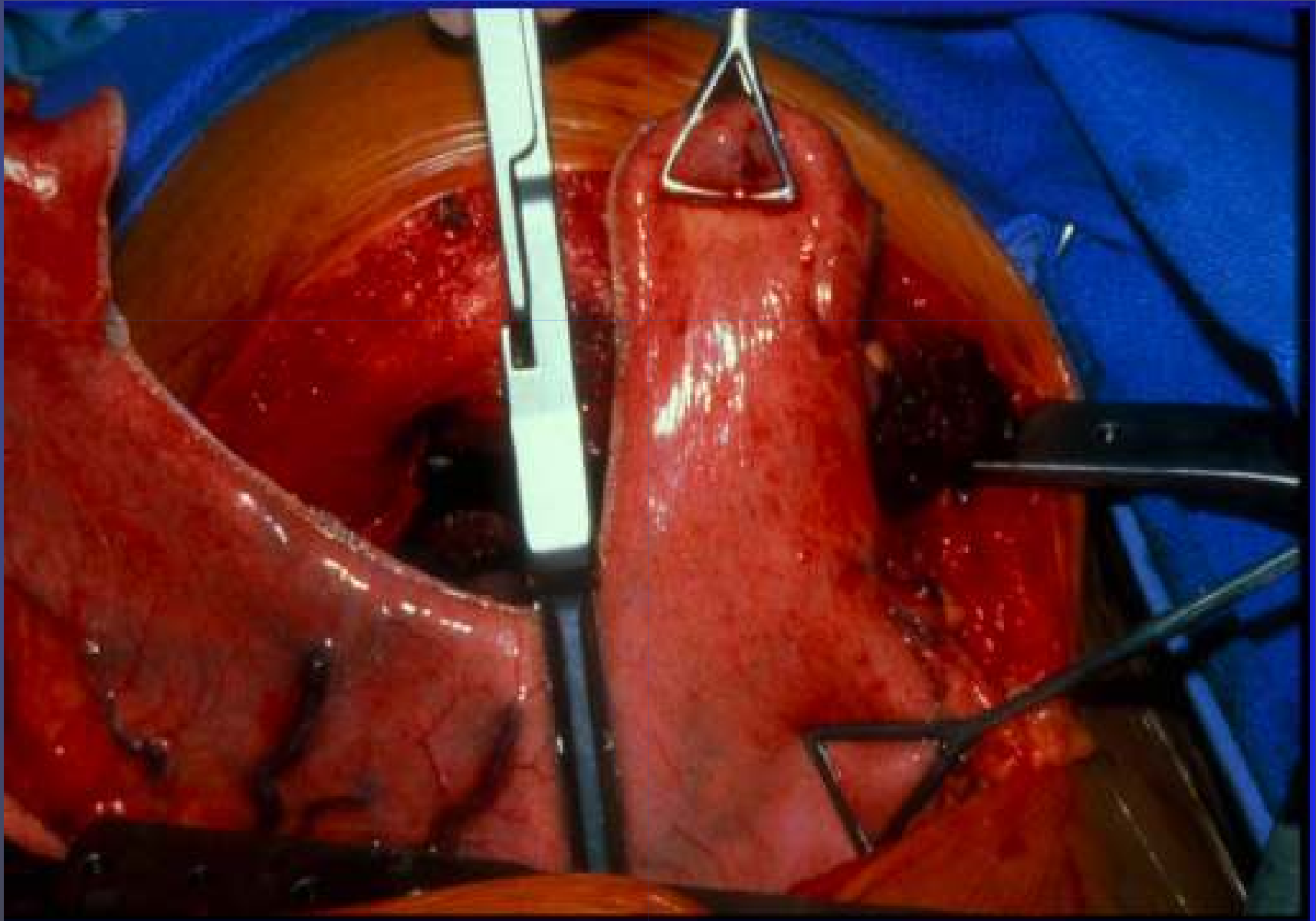


# Ivor Lewis Stage 2: Right thoracotomy

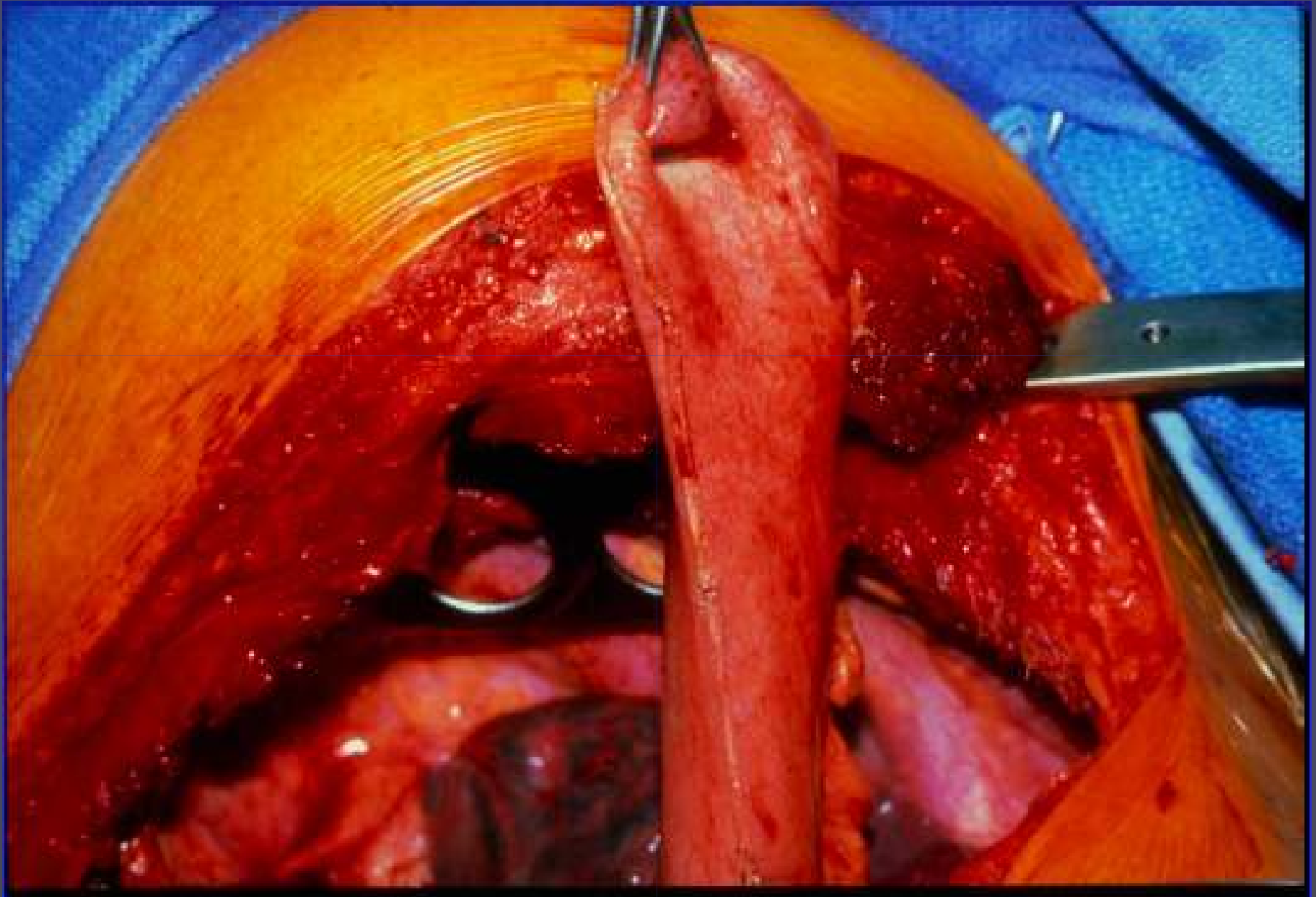
- Mobilization esophagus
- Mediastinal LN dissection
- Proximal division esophagus



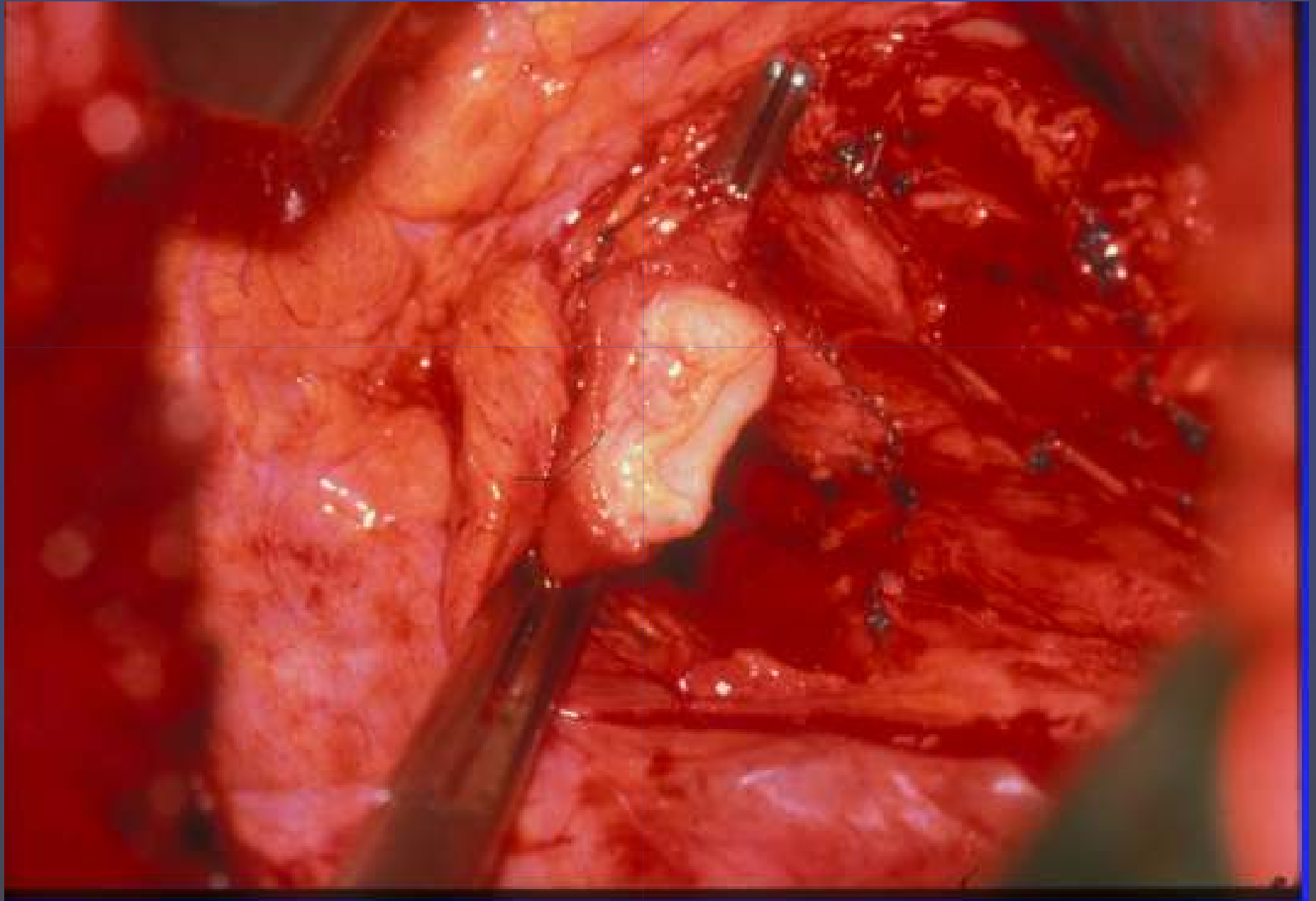
# Gastric tube stapling



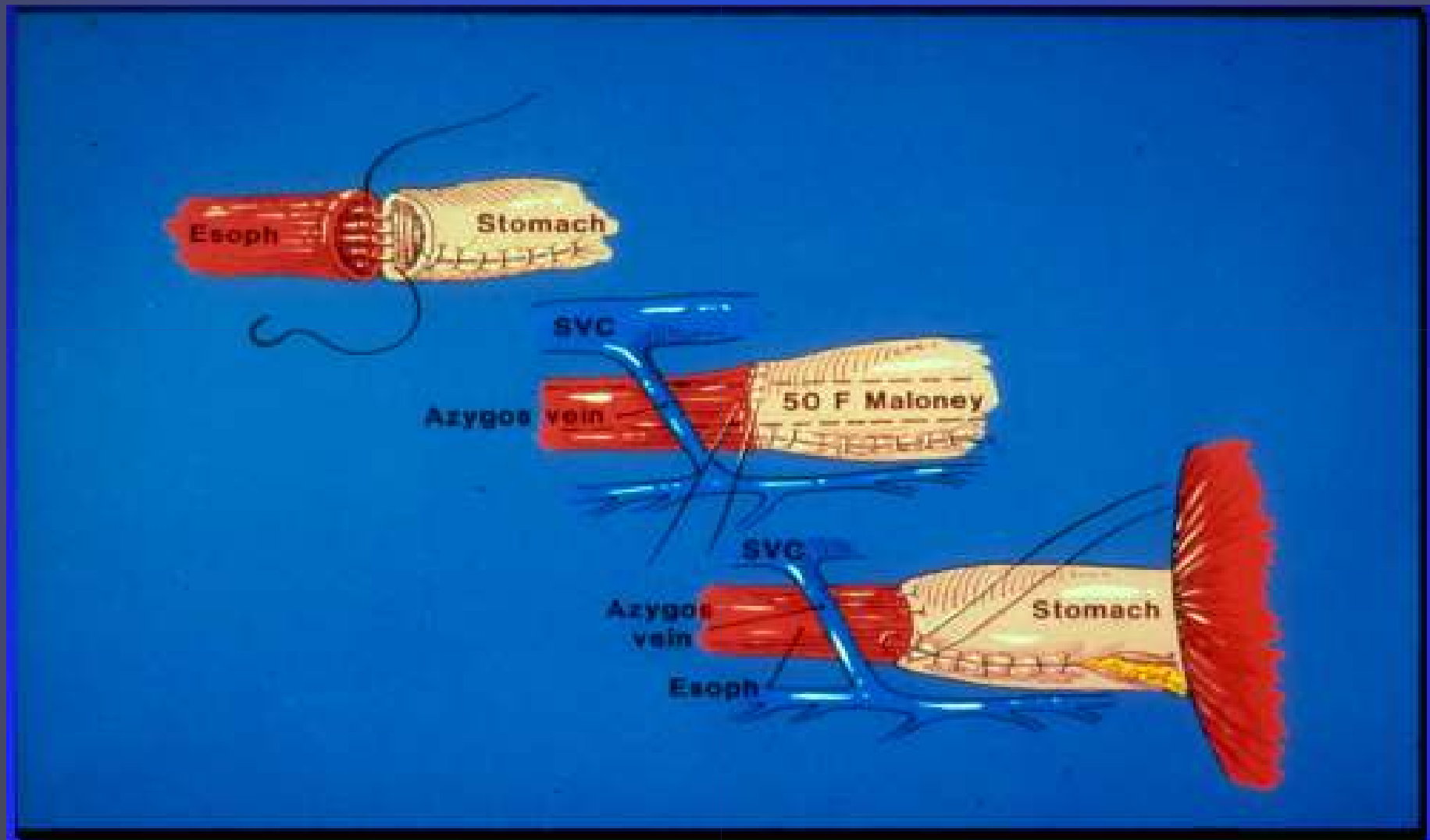
# Gastric tube length

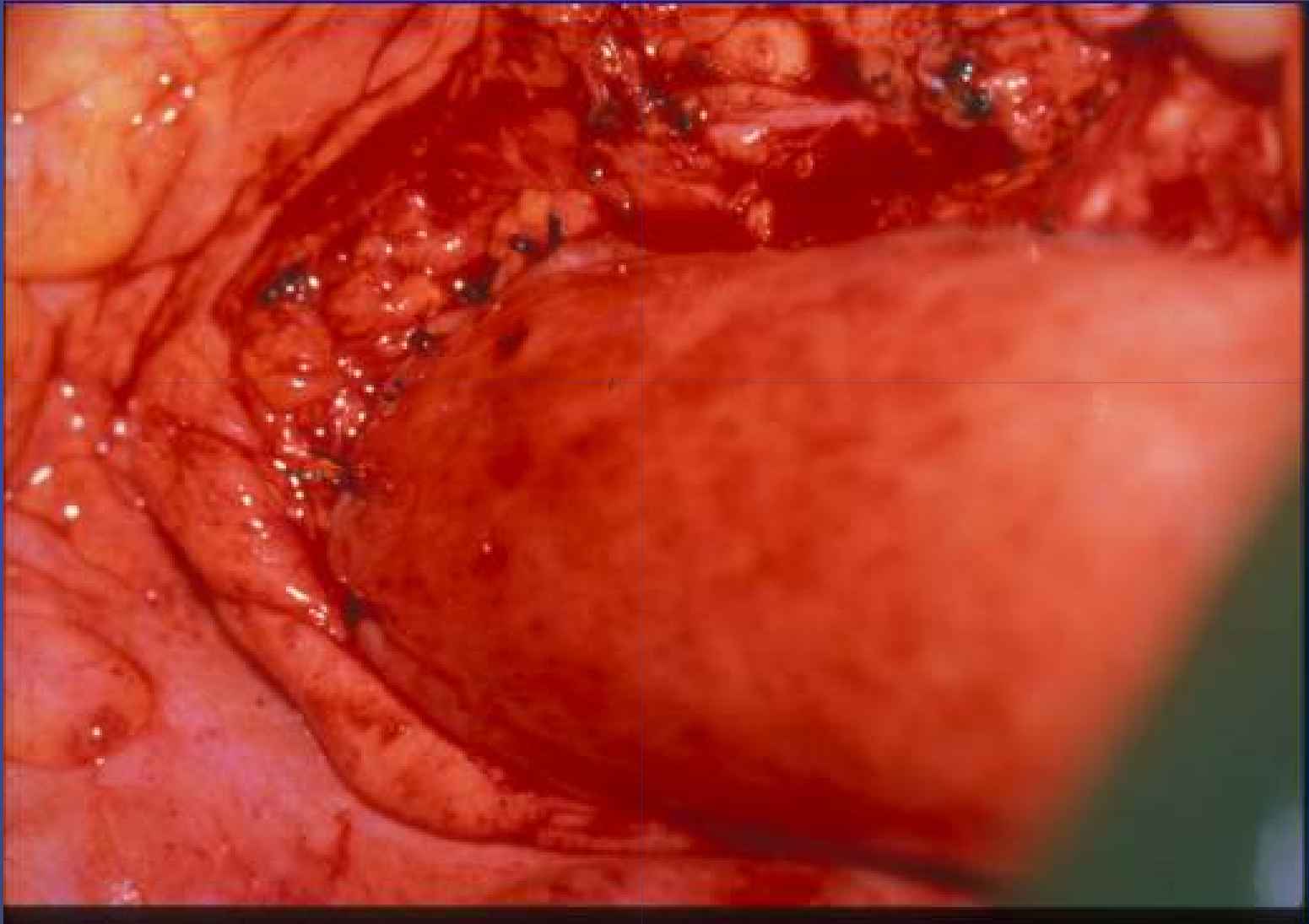


# Proximal esophagus divided

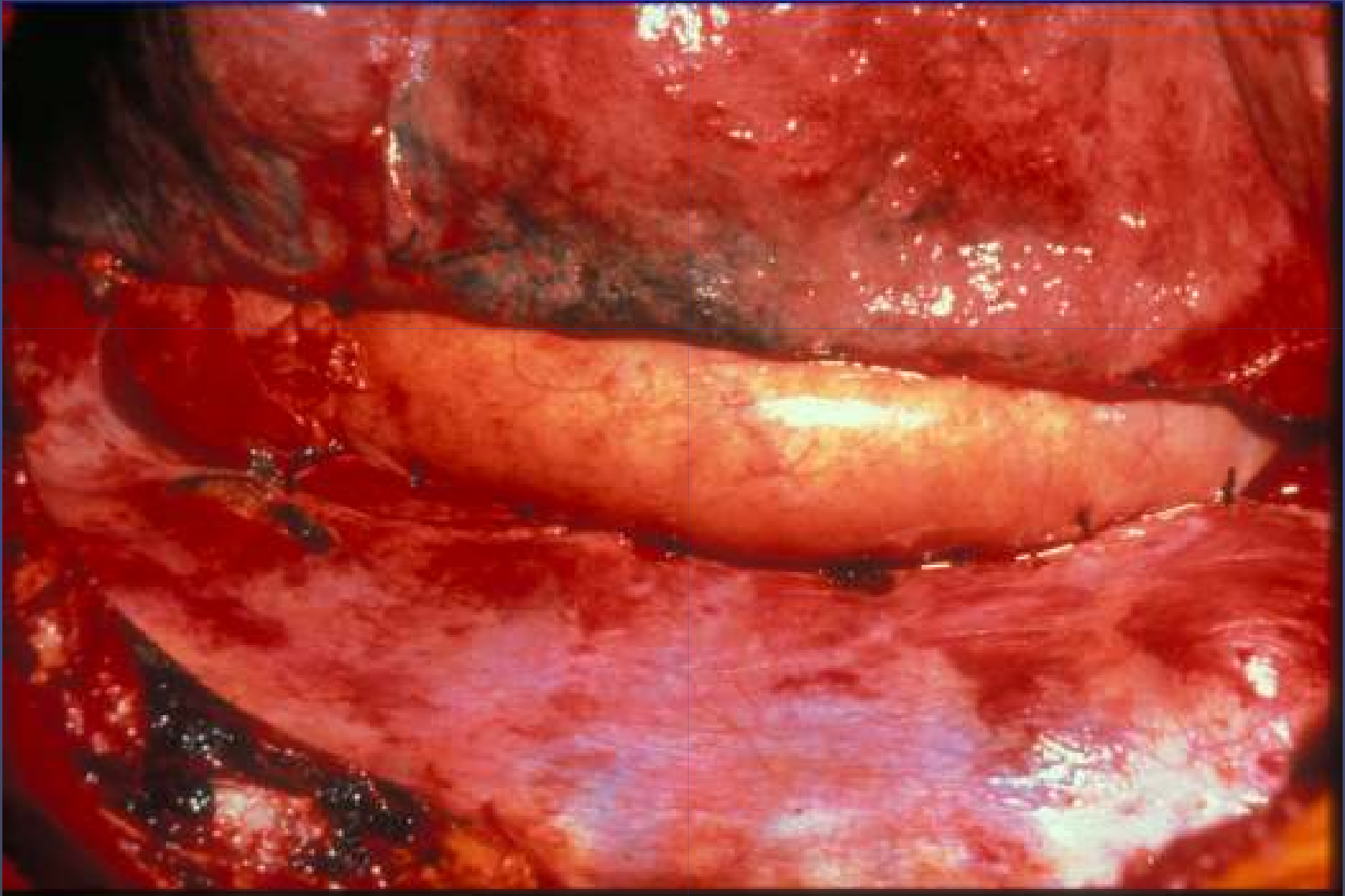


# Intrathoracic anastomosis





# Gastric tube in posterior mediastinum



# Ivor Lewis Esophagectomy

## PROS

- Direct visualization, dissection of esophagus, LNs

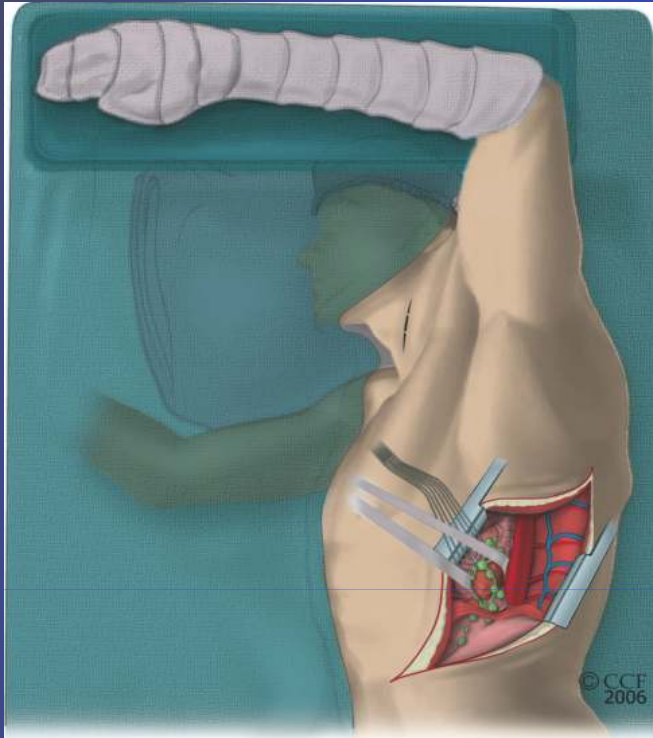
## CONS

- 2 incisions, repositioning
- Higher pulmonary morbidity
- More postop pain
- Morbidity intrathoracic leak
- May not have adequate proximal margin for mid esophageal tumors

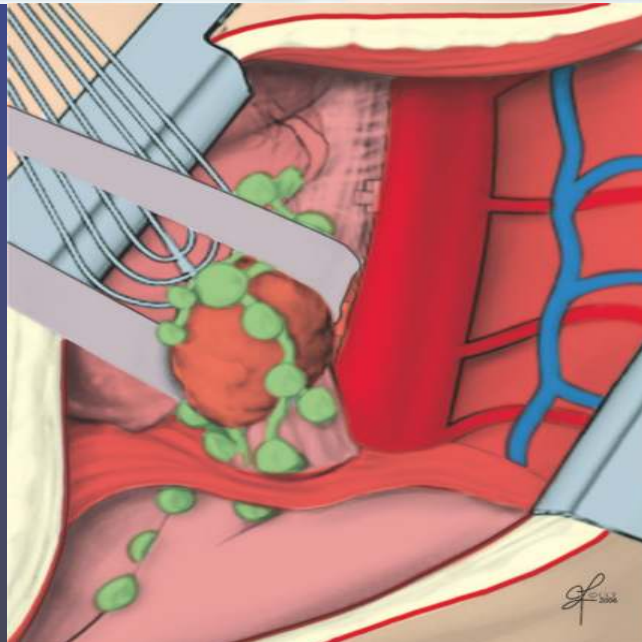




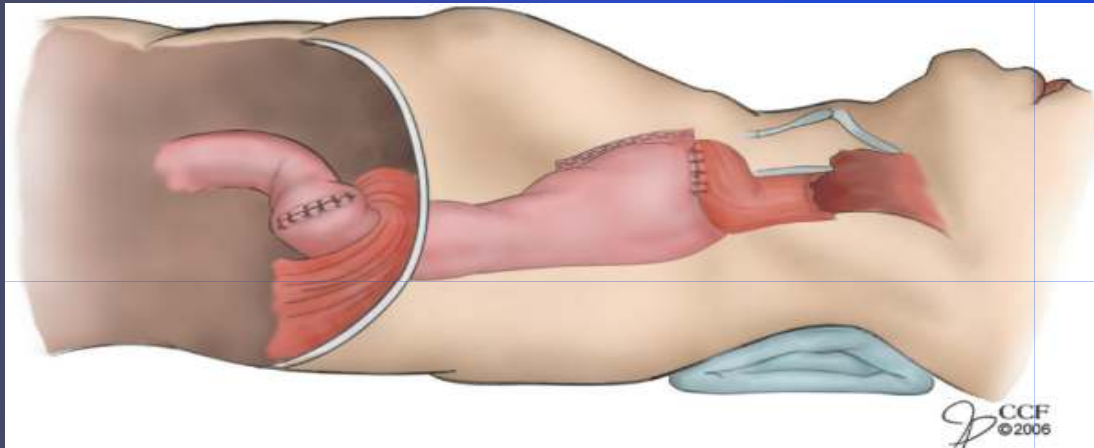
# Left Thoracoabdominal esophagectomy



- Dissection thoracic esophagus, mediastinal LNs
- Mobilization stomach



# Thoracoabdominal esophagectomy



- Construction gastric conduit
- Intrathoracic or cervical anastomosis
- One huge incision – no need for repositioning
- Need to cut diaphragm, costal cartilage – pain, pulm complications

# Thoracoabdominal esophagectomy

- Single incision (2 if neck anast)
- Direct exposure thoracic esophagus, mediastinal LNs as well as upper abdomen
- Can do total gastrectomy, Roux Y anastomosis with distal esophagectomy
- Tumor above 30 cm – obscured by aortic arch
- Low intrathoracic anastomosis – high incidence reflux
- Costal cartilage incision complications – non union
- Diaphragm incision
- Unfamiliar orientation
- Pulmonary complications

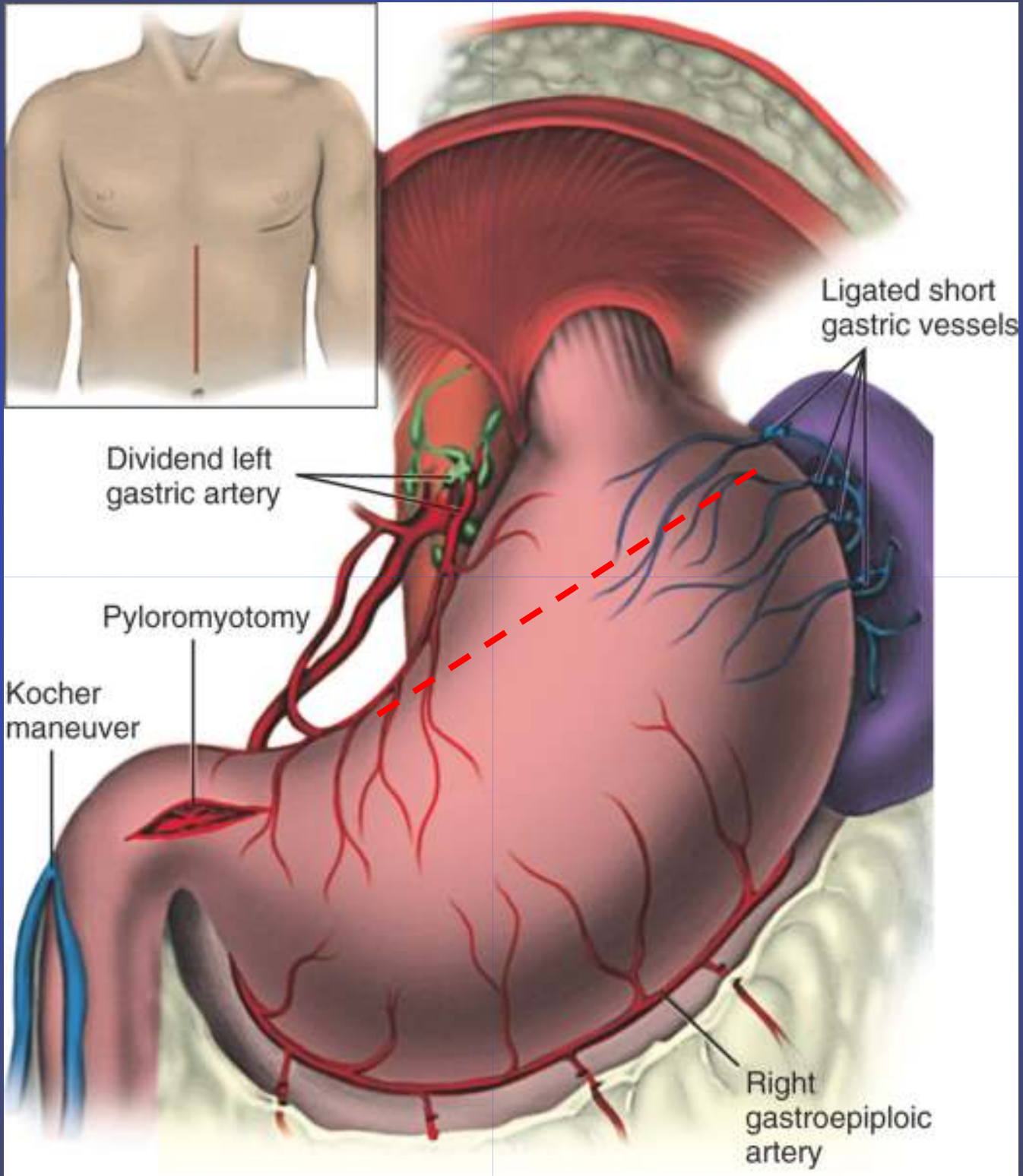
# Transhiatal esophagectomy

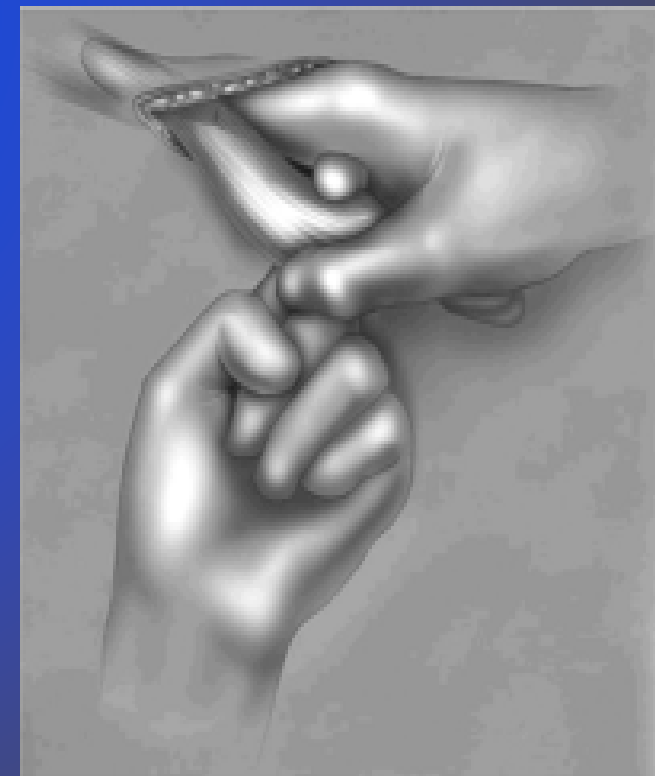
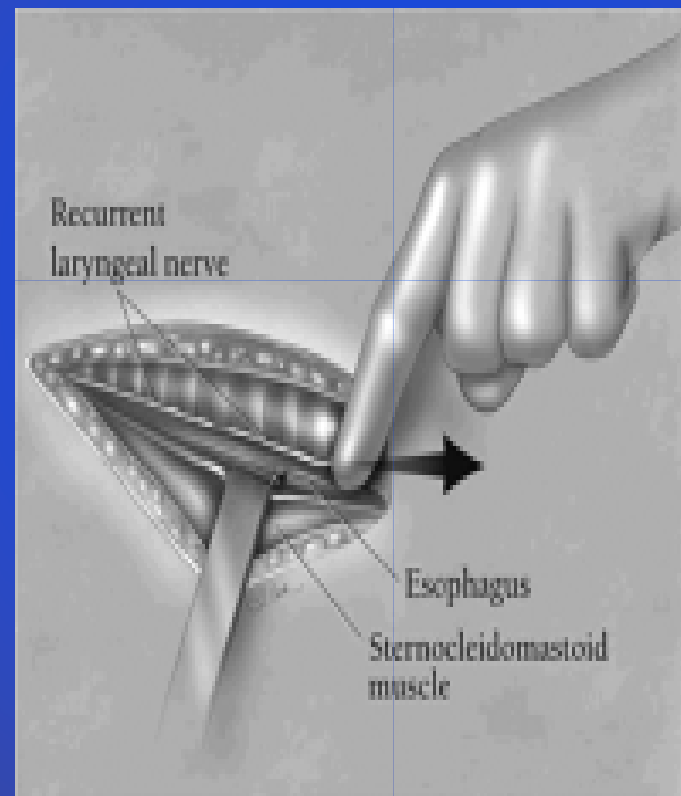
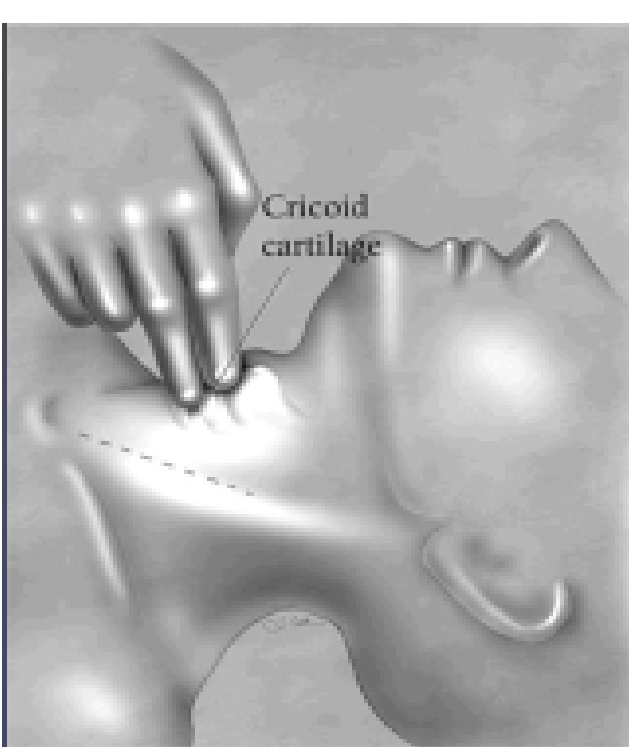
Pioneered by Dr. Mark Orringer  
– U Michigan 1978

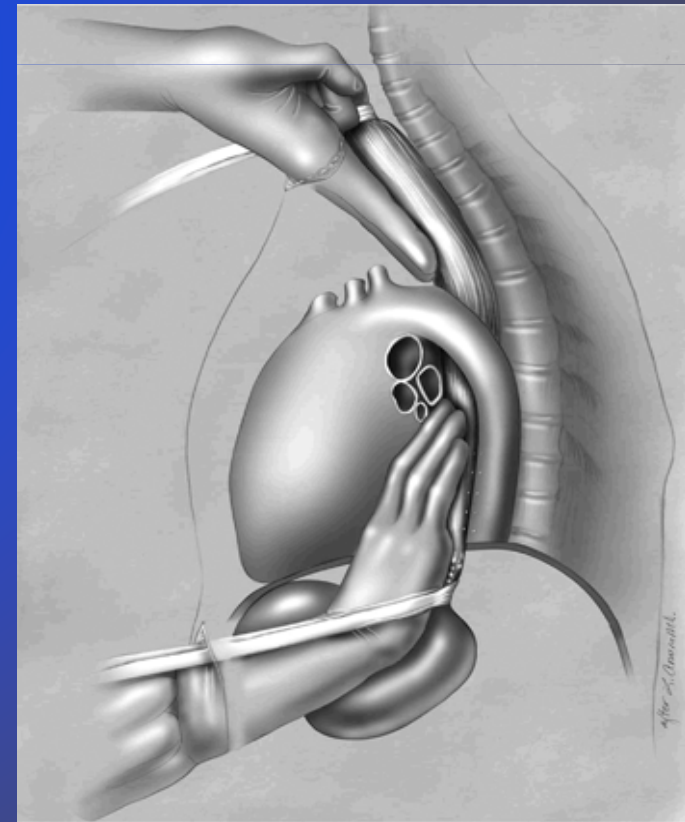
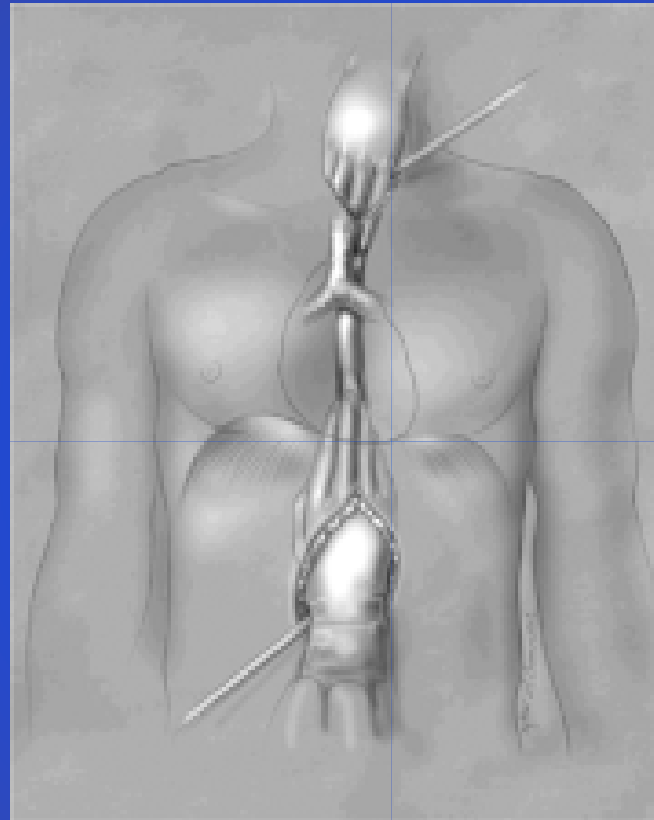
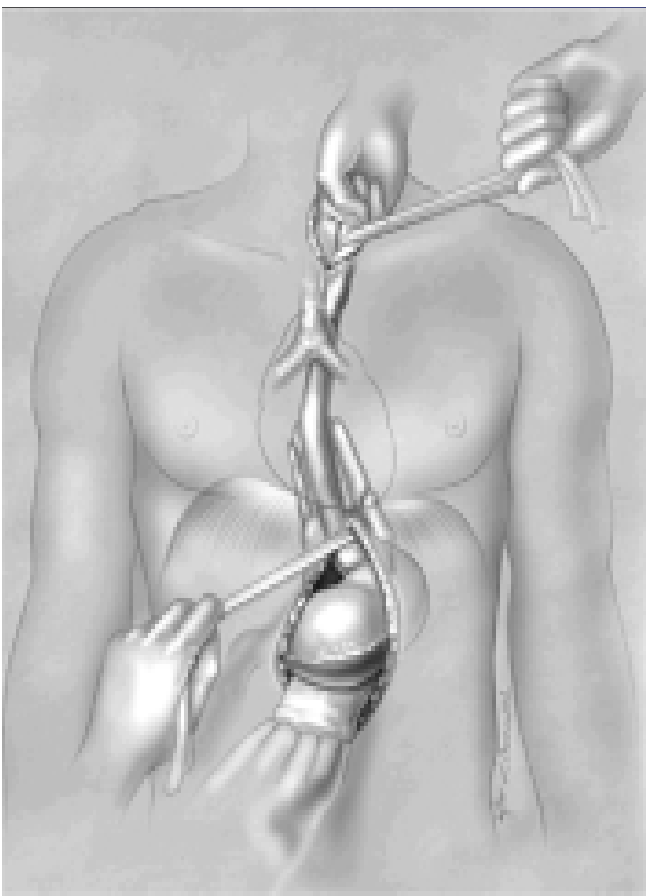
Main objective – removal of  
esophagus without chest  
incision, through hiatus of  
diaphragm:

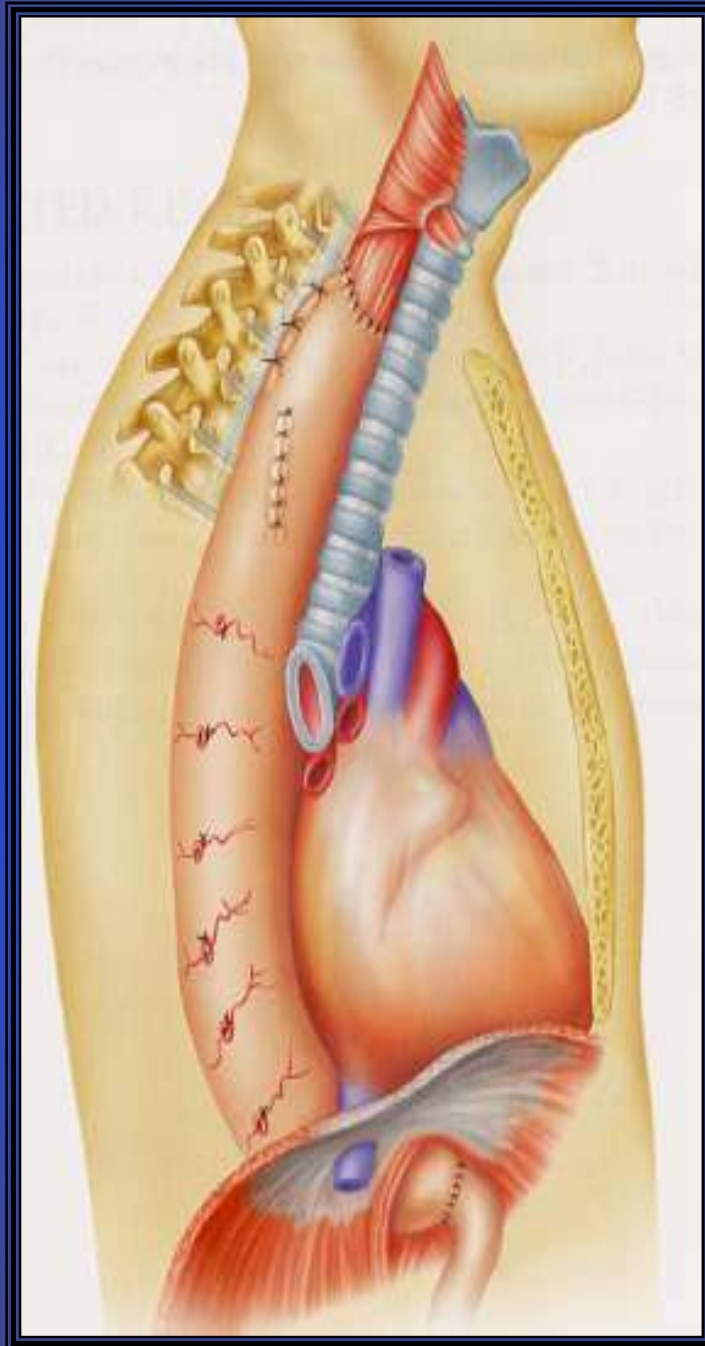
- 1) Abdominal incision –  
laparotomy
- 2) Neck incision













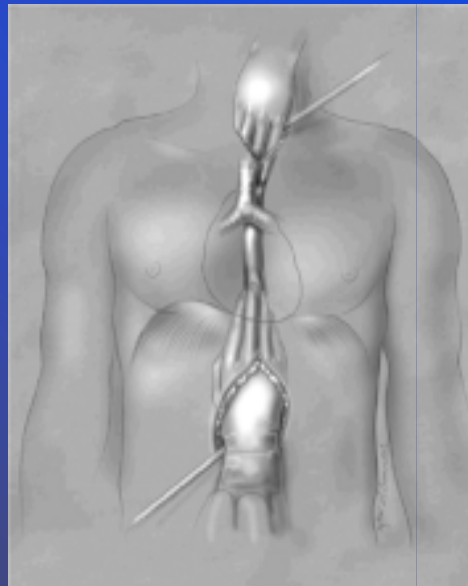
# Transhiatal esophagectomy

## PROS

- No thoracotomy → less pulmonary morbidity
- No need to reposition
- Cervical anastomosis –leak easier to manage

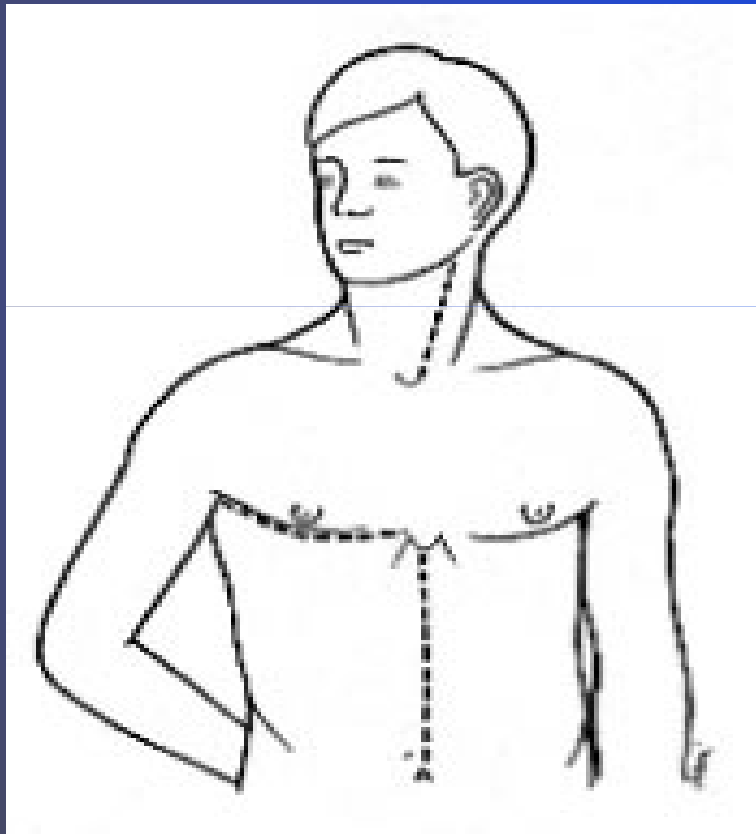
## CONS

- Frequent anastomotic complications
- Risk RLN injury
- Lack direct exposure: bleeding, injury adjacent structures
- Mediastinal nodal clearance suboptimal



# McKeown / 3 hole Esophagectomy

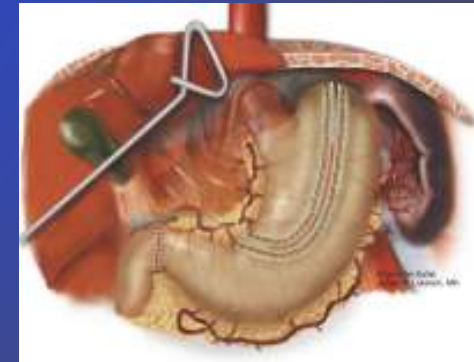
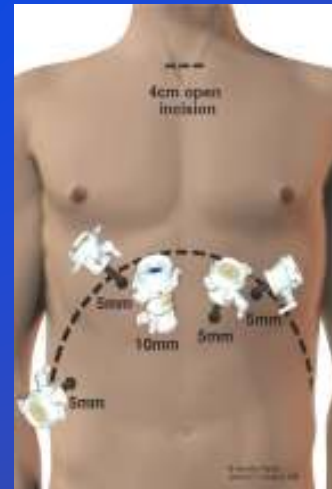
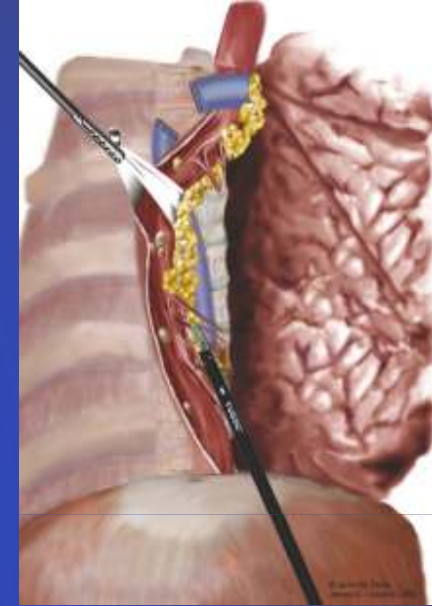
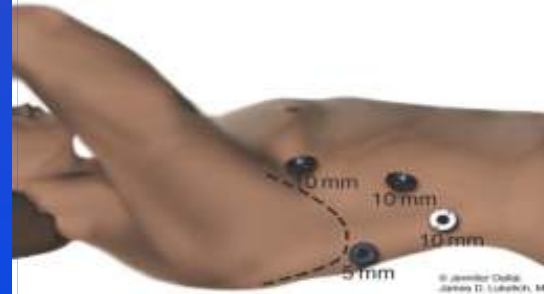
- Combines advantages of Ivor Lewis and transhiatal approaches



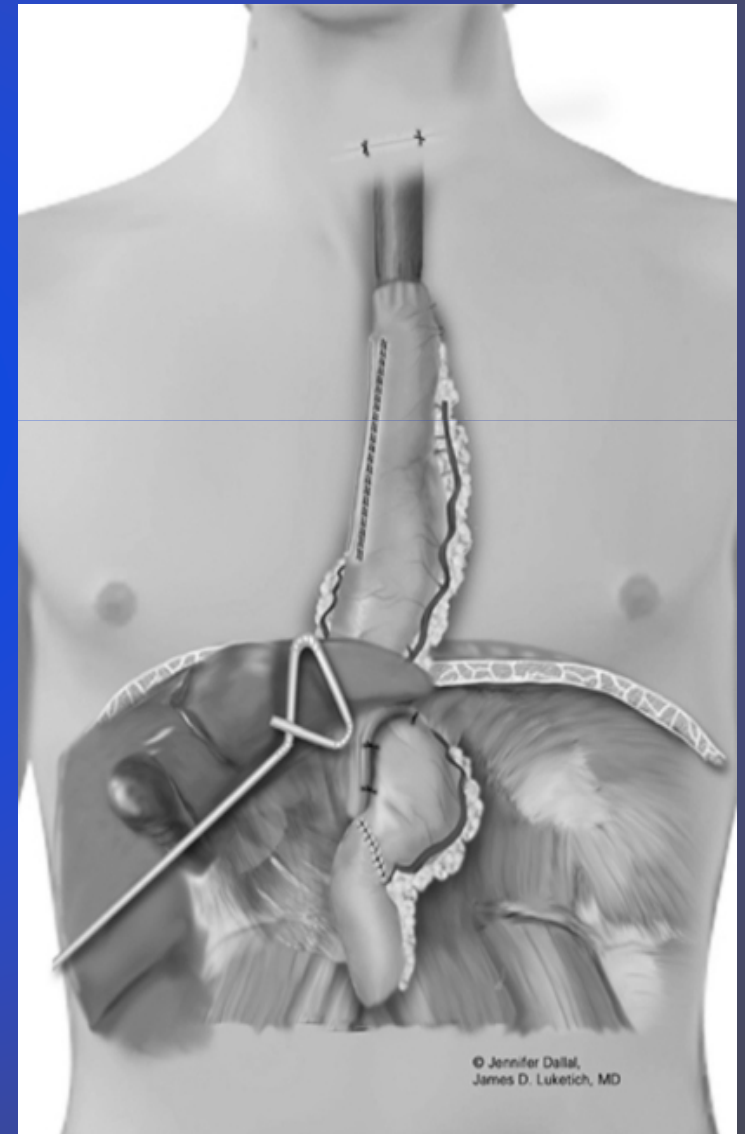
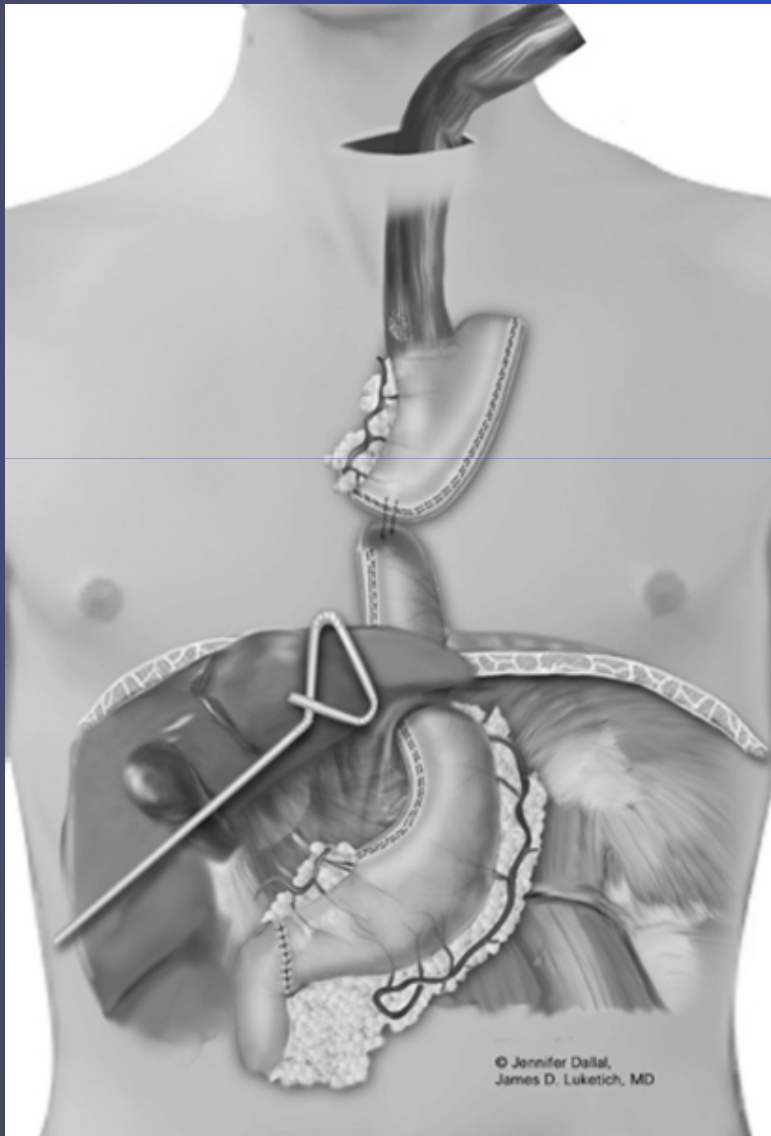
# Minimally Invasive Esophagectomy techniques

- Variety of thoracoscopic and laparoscopic techniques

→ controversial: longer OR time, questionable benefit in terms of decreased morbidity, hospital stay



# Cervical anastomosis



# RCT Esophagectomy

## *Transhiatal vs. Transthoracic*

|            | <b>THE</b> | <b>TTE</b> |        |
|------------|------------|------------|--------|
| No. Pts.   | 106        | 114        |        |
| Pulm Compl | 29 (27%)   | 65 (57%)   | <0.001 |
| ICU Days   | 2 (0-38)   | 6 (0-79)   | <0.001 |
| Op Mort    | 2 (2%)     | 5 (4%)     | 0.45   |
| Relapse    | 62 (58%)   | 57 (50%)   | 0.60   |
| 5-yr Surv. | 27%        | 39%        | 0.12   |

# Complications of esophagectomy

- A lot!! (potentially)
- Complex, high risk operation
- Often malnourished, post chemoradiation – immune suppr
- Optimize preop – smoking cessation, nutrition, exercise

# Complications of esophagectomy

**Respiratory** – atelectasis, aspiration, pneumonia, resp failure  
- ?higher in transthoracic approach

→ adequate analgesia, incentive spirometry, pulmonary toilet, physiotherapy, elevate head of bed to prevent aspiration

# Complications of esophagectomy

## Recurrent laryngeal nerve injury → vocal cord paralysis

- higher with cervical anastomosis

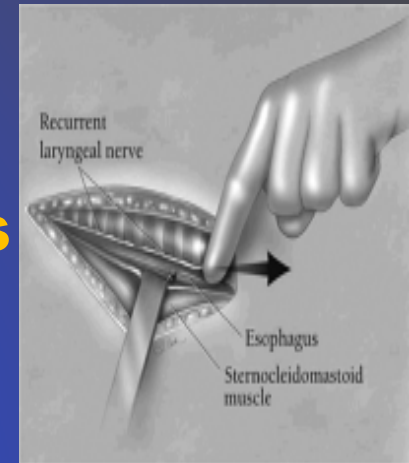
(11 vs. 5% thoracic anastomosis, Rindani, ANZJS 1999)

- hoarse, ineffective cough, recurrent aspiration, impaired swallowing

- may resolve with time (mild traction injury)

  - Tx - vocal fold medialization:- transoral injection

  - laryngoplastic reconstruction





# Complications of esophagectomy

## Thoracic duct injury

TD-collects lymphatic fluid body → venous system

Chyle leak:

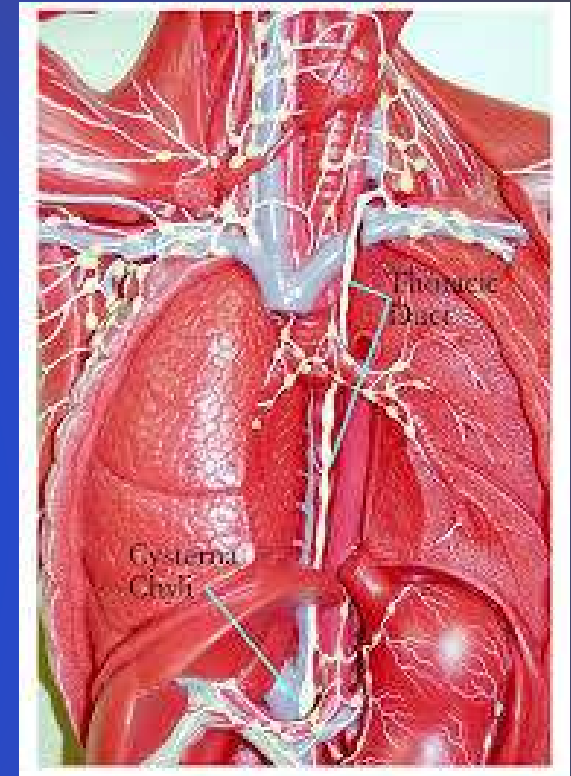
– 2-10%

- lymphatic fluid: classic milky appearance, elevated TGs, chylomicrons

- low output leak: NPO, TPN / medium chain triglyceride diet, octreotide

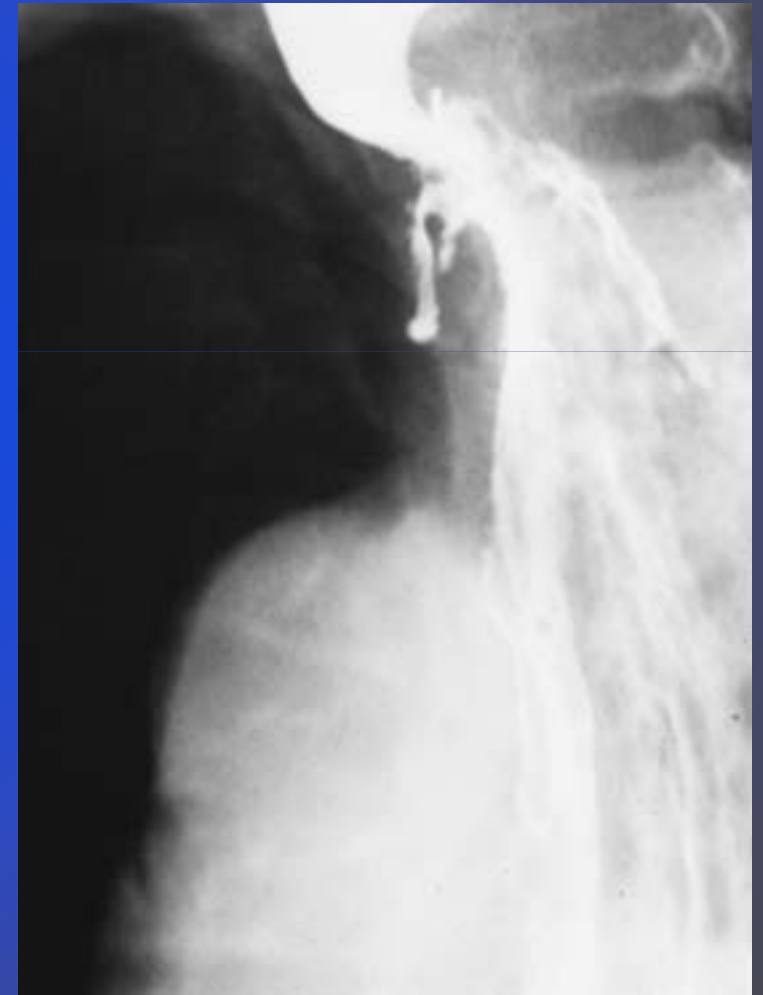
- high output leak – dehydration, immune suppression, malnutrition...

Tx - R thoracotomy, TD repair or ligation (give cream preop to help localize)



# Complications of esophagectomy: conduit problems

- **Anastomotic leak:**
  - Usually higher following cervical anastomosis – increased length of conduit, tension, compromised blood supply
  - Ischemia, malnutrition, DM, neoadjuvant therapy other risk factors



# Complications of esophagectomy: conduit problems

## Anastomotic leak – Diagnosis

### Cervical leak:

- Most present POD 5-10
- Fever, drainage, erythema, neck swelling

### Intrathoracic leak:

- More insidious: malaise, leukocytosis, fever, pleural effusion
- Rapid deterioration if unrecognized

### Fulminant leak:

- due to major technical error, conduit necrosis
- 48-72 hrs – hemodynamic instability, foul drainage



# Complications of esophagectomy: conduit problems

## Anastomotic leak – Management

### Contained asymp leak (cervical / thoracic)

- Antibiotics, NPO
- Repeat imaging 5-7 days

### Cervical leak: fever, neck drainage, erythema

- Open wound, pack, antibiotics, nutrition
- Monitor symptoms – risk descending mediastinitis

### Intrathoracic leak: effusion, fever

- Drainage pleural space (re-expand lung), antibiotics, nutrition
- Re-exploration usually necessary – primary repair / takedown conduit



# Complications of esophagectomy: conduit problems

## Fulminant Leak / septic

- 48-72 hrs postop – foul drainage, unstable pt
- Extensive necrosis:
  - takedown anastomosis, resection non-viable segment, return viable conduit abdomen, cervical esophagostomy, gastrostomy
- Limited necrosis:
  - local repair with vascularized pedicle flap buttress



Figure 1: Mobilization of oesophageal pouch for extrathoracic lengthening.

# Stent for Esophageal Anastomotic Leak

Covered stent deployed across defect, prevent further contamination, allow healing

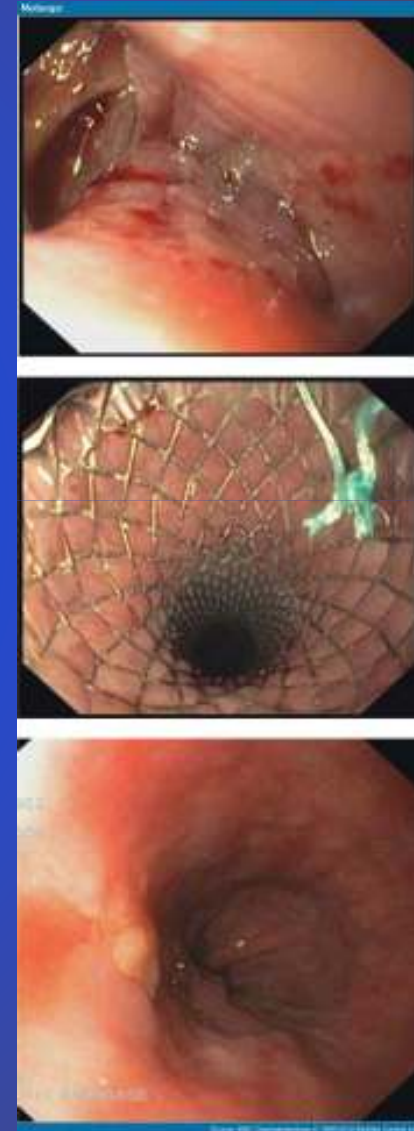
Avoid morbidity of surg, save conduit

Many series report successful resolution leaks

Only for patients with healthy conduit, limited necrosis, defect <25% circumference

Remove after 3-4 weeks to prevent tissue ingrowth

Risk migration...



# Complications of esophagectomy: conduit problems

## Anastomotic Stricture

Incidence 5 - 44%

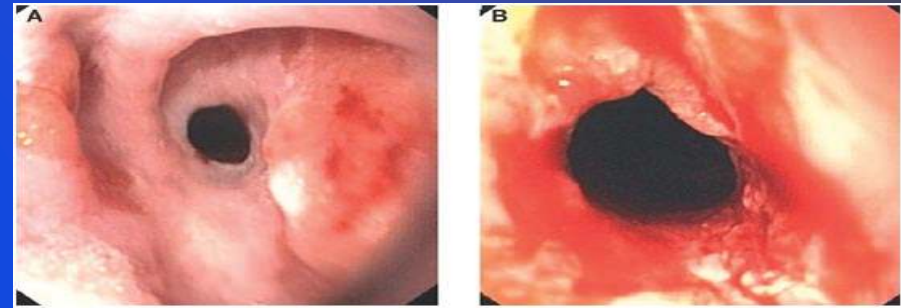
Risk factors: **previous leak**, radiation, reflux esophagitis

Should start esophageal dilatations after recovery from leak

Some will need repeat procedures

Late anastomotic stricture – R/O recurrent ca

Persistent stricture – surgical revision



# Complications of esophagectomy: GI issues

- Swallowing dysfunction
- GERD
- Delayed gastric emptying
- Dumping syndrome – cramping, bloating, osmotic diarrhea
- Early satiety
  - Smaller frequent meals, PPI, elevate head of bed, low carb meals
  - Watch for symptoms of aspiration



# Take Home Messages

- Surgery remains mainstay of treatment for resectable operable pts
- There is no ideal approach to esophagectomy
- In order for surgery to have an impact on survival perioperative mortality and morbidity must be low
- Many potential complications esophagectomy – early recognition and timely management essential
- Esophageal stents – palliation dysphagia for non-surgical pts, tx anast leak, but need to be mindful of potential complications

# Thanks!

