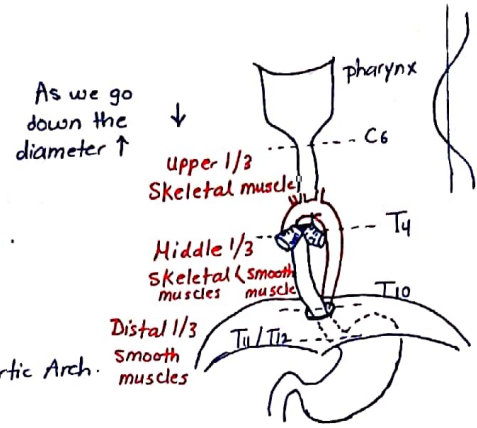


Esophagus

* Anatomy:

- Esophagus is 25 cm long, lies in Posterior mediastinum.
- Extends from Cricopharyngeus muscle at level of Cricoid cartilage (C6) & ends at the level of GEJ (T11/T12) after entering the diaphragm at T10.



* Points of Narrowing:

- ① UES at level of Cricopharyngeus (C6)
- ② At level of (T4) → left main Bronchus, left Atrium, Aortic Arch.
- ③ Passage through the diaphragm (T10)

* Esophageal sphincters:

Upper E. sphincter	Lower E. sphincter (HPZ)
<ul style="list-style-type: none"> - True Anatomical sphincter composed of: 1- Cricopharyngeus 2- Inferior pharyngeal Constrictor muscle. - Pressure is 45 mmHg. - Prevent Aspiration of food & saliva. 	<ul style="list-style-type: none"> - No specific Anatomical sphincter (4cm long), related to architecture of muscle fibers: ① Intrinsic esophageal muscles. ② Phreno-esophageal ligament. ③ Sling fibers of stomach cardia. ④ Sling fibers of crura of diaphragm. - Pressure is 10 - 20 mmHg. - prevent reflux of Gastric Contents.

* Blood Supply:

	Arterial	Venous Drainage → from submucosal venous plexus
Cervical	Inferior thyroid A.	Inferior thyroid vein
Upper Thoracic	Bronchial & intercostal	Azygos vein → SVC
Lower Thoracic	Aortic Branches	
Abdominal	Left Gastric A. Inferior phrenic A.	Gastric Veins → portal circulation

Porto-Systemic Anastomosis
Is the cause of varicies in Portal HTN

* Lymphatic Drainage: (Non-segmental Drainage)

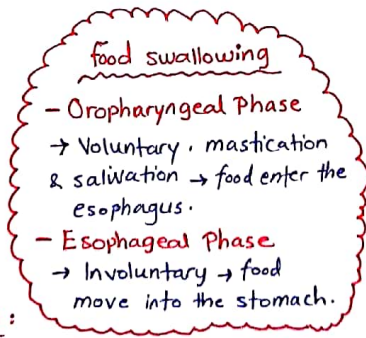
- Dense submucosal lymphatics → lymph flow run longitudinally for long distance before draining into lymph vessels in Adventitia.
- ↳ In Upper 2/3 → Cranial
- ↳ In Lower 1/3 → Caudal
- (Tumors & Infections can extend for considerable length)

* The Only part that has segmental Drainage is the Cervical Esophagus & drain into regional LNs.

* Physiology:

* How LES prevent Reflux?

1. Acute Cardio-Esophageal Angle.
2. Pinching effect of the diaphragm.
3. Attach stomach to Diaphragm.



* Components of Antireflux mechanism:

1. Effective LES.
2. Efficient esophageal clearance.
3. Adequately functioning gastric reservoir. (Bariatric surgery impaires it)

* Physiologic Reflux:

- Healthy Individuals have episodes of GERD seen on 24 hours Esophageal PH monitoring.
- Tend to occur when you're Awake & In Upright Position.
- Esophageal Peristalsis washout Acid during sec. - minutes.

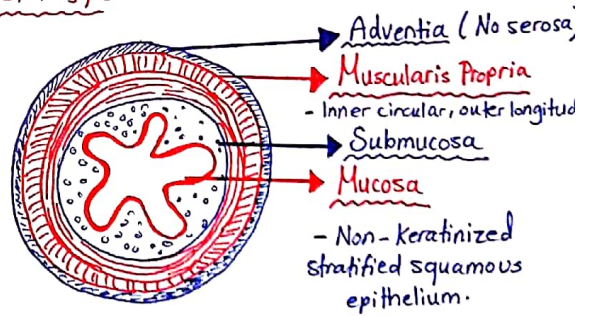
* Nerve Supply: Right & Left vagus nerve.

(if damaged no effect on the function)

→ Carry Both Excitatory & Inhibitory fibers to LES.

Tumor & Infections spread easily.

* Histology:



* The Junction Between sequamous epithelium & columnar epithelium at the stomach called Z-line.

* factors that:

↑ LES Tone	↓ LES Tone
- Gastrin, Motilin, PGE ₂	- Estrogen, Progesterone, CCK, Somatostatin, Glucagon, PGE _{1/2}
- Antacids, Cholinergics, Domperidone, Metoclopramide, NSAIDs, Histamin. α Agonist & β-Blockers.	- Atropin, Barbituate, Dopamin, CCB, Diazepam, Theophyllin, β-agonist & α-Blockers.
- Bombesin, Enkephalin, Substance P.	- Gastric Inhibitory Peptide, VIP, Neuropeptide.
	- chocolate, spices, fat, coffee ethanol

Esophageal Motility Disorders

Hypertensive Motility Disorder

- * Hallmark is Dysphagia to Both Solids & liquids at onset.
- * First Diagnostic Test should be Upper GI Endoscopy to R/O Tumor
- * Manometry is the Test of choice to diagnose motility disorders.
 - ↳ Assess motor pattern, contraction amplitude, LES pressure.

1) Achalasia:

- Failure of LES to relax due to loss of Myenteric plexus (Auerbach's Plexus) - Could be Autoimmune, or due to Adenocarcinoma or Chagas Disease (T. Cruzi)

* Clinically:

1. Dysphagia for Both solids & liquids at onset
2. Regurgitation at night (may cause Aspiration) → If recurrent pneumonia & cough suspect it.
3. Weight loss
4. Retrosternal chest pain, Heartburn (30%) - related to food fermentation & lactic acid.

* Diagnostic Tests:

1. first test → Endoscopy to R/O Ca. (Dilated Esophagus & food remnants)
2. Barium Swallow → Bird Peak sign. (95% Accurate)
3. High Resolution Manometry → Shows failure of LES to relax & Aperistalsis of esophageal Body (Distal 2/3)

* Treatment: (The Only disorder that could be treated surgically)

- ① Pneumatic Balloon Dilatation: ↑ the Risk of Perforation During Heller. (Could be repeated 2-3 times)
- ② Medical treatment: 1. Nitrates or CCB.
2. Botox injections. → "DOR"
- ③ Heller Myotomy with Anterior fundoplication (if failed Balloon Dilatation)
 - ↳ Could be open (upper midline) or Laparoscopic (Recommended)

* Patients should be followed up with EGID for life (Because x33 times ↑ Risk of Cancers) & operation don't ↓ the Risk.

Hypotensive Motility Disorder

- Relaxed (Hypotensive LES) → Patient complain from Acid reflux.
- Treatment: 1) Antacids
2) Anti-reflux → PPI (Esomeprazole)
3) Prokinetics → motilium, erythromycin

Both are:

1. DDX for: Angina pectoris → Chest pain that mimic Angina is the hallmark.
2. On HRM shows: 1. High Amplitude Contractions & normal lower Esop. sphincter
3. Treated medically
 1. CCB & Nitrates
 2. Antireflux.

2) Diffuse Esophageal spasm:

- Strong, simultaneous non-peristaltic contractions of the esophagus & usually normal sphincter function
- Associated with GERD.
- Barium Swallow shows Corkscrew esophagus.

3) Nutcracker Esophagus:

- Hypertensive peristalsis (Very strong peristaltic waves)

Secondary Motility Disorders

1. Severe Esophagitis.
2. Stroke
3. Parkinsonism.
4. Alcohol
5. Scleroderma (suspect if Proximal normal peristalsis & Absent distal)
6. DM.

* Most Effective Current treatment for Achalasia is Laparoscopic Cardiomyotomy.

Esophageal Diverticulum

false diverticulum

Zenker Diverticulum

- The most common, occur in upper 1/3.
- UES fail to relax → ↑ Intraluminal pressure → Outpouch through Area of weakness (> 50yrs old) - Killian Triangle.
- Clinically: Halitosis, Dysphagia, weight loss, Regurgitation.
- Treatment: Cricopharyngeal myotomy & Diverticulectomy.

* Diagnosed by Barium Swallow.

Traction Diverticula

- Occur at midpoint of esophagus
- Hilar lymphadenopathy & scarring from TB infection → Traction of the esophagus.
- Asymptomatic & don't need ttt.

Epiphrenic Diverticula

- Occur at lower 1/3 of esophagus.
- Assoc. with Achalasia
- Treated by Esophagomyotomy & Diverticulectomy.

Hiatal Hernia

- Esophageal Hiatus is opening in the Diaphragm where esophagus & phagus nerve pass.
- The distal esophagus held in place by phreno-esophageal ligament

- Causes: 1- Age 2- ↑ Intra-abd. pressure → Pregnancy
Ascites weight lifting.

* Types: ↳ Assoc. with Schatzki Ring

	Type 1 (Sliding Hernia)	Type 2 (paraesophageal)
%	> 90%	< 5%
Portion Herniated	- GE Junction & Part of the stomach herniate through Esophageal hiatus.	- Stomach (mostly fundus) herniate into the thorax through Esophageal Hiatus but GEJ remain under diaphragm.
Complications	① GERD (most common) ② Reflux Esophagitis ③ Esophageal Ca. ④ Aspiration * 92% Asymptomatic.	① Obstruction ② Incarceration ③ Strangulation.
Treatment	1- Antiacids 2- Lifestyle modification 3- 15% need surgery	- Surgery to reduce the hernia to prevent cut off the Blood supply.

* Type 3 → Combined

* Type 4 (Giant) → Involve other organs.

* Diagnosis: (Mostly found incidently)

- ① Barium Swallow
- ② EGD (Endoscopy) → confirm Hiatal hernia if finding a pouch lined with rugal folds 2cm or more above diaphragmatic crura.

* Mallory Weiss Syndrome

- Mucosal tears near GEJ as a result of forceful vomiting (Common in Alcoholics)
- Lead to Hematemesis (90% stops spontaneously)

* Diagnosis: - Dx by upper Endoscopy.

* Treatment: 1- Oversewing the tear
2- Angiographic Embolization.

Dysphagia → Solid & Liquid at Onset → motility disorder → Barium Swallow > Manometry.
 ↳ Progressive (solid then liquid) → Tumor → Barium Swallow > Endoscopy with Biopsy > CT (To determine operability)

Esophageal webs

Plummer-Vinson Syndrome

- Upper Esophageal web.
- * Triad of: ① Dysphagia
② Iron Deficiency Anemia (Koilonychia)
③ Atrophic Oral Mucosa (Glossitis)

* Premalignant lesion ↔
↳ Can develop into SCC.

* Treatment:

1. Iron Supplement
2. Esophageal dilation.

Schatzki Ring

- Distal Esophageal web.
- Circumferential ring in Lower esophagus.

* Etiology:

- ① Acid Ingestion → Mucosal necrosis.
- ② Alkaline Ingestion → full thickness Necrosis → Need Esophagectomy (liquifactive)

* Symptoms:

- Usually Asymptomatic
- Can cause mild dysphagia

* Treatment:

- If without reflux → Esophageal dilation
- If with Reflux → Anti-reflux surgery

Esophageal Perforation

- Emergency.

* Causes: ① 60% Iatrogenic (following dx or Rx procedures)

- Due to sudden ↑ in Esophageal pressure (vomiting)
 - ② Spontaneous Perforation (Boerhaave Syndrome) - 15%
↳ Most common site is into left pleural cavity or 3-5 cm above GEJ.
 - ③ Foreign Body 15%
 - ④ Trauma 10%

* Symptoms: 1- Striking symptom → Severe retrosternal pain
2- SubQ. Emphysema (Hamman Sign) → Heartbeat against air filled tissue.

* Diagnosis: ① CXR → Air in Mediastinum.
② Definitive Dx → CT with Gastrographin swallow

* Treatment

Early (4-6 hours)

- ① Close perforation
- ② Drain the affected area
- ③ Nutrition.

Late (48-72 hours)

- ① Divert saliva away from perforation (due to friable tissue).
- ② Clean mediastinum.
- ③ Gastrostomy or Colostomy.

Gastroesophageal Reflux Disease.

* Definition: Relaxation of LES (\downarrow LES tone) leading to reflux of gastric content into LE.

- * Causes:
- ① \downarrow esophageal motility. (clearance)
 - ② Hiatal Hernia
 - ③ Gastric Outlet Obstruction or \downarrow Gastric Emptying.
 - ④ Smoking, DM, scleroderma, Obesity, lifestyle.

* Classical Symptoms:

- ① Retrosternal heartburn. \hookrightarrow \uparrow with food
- ② Epigastric pain. \hookrightarrow \uparrow with lying down
- ③ Regurgitation.
- ④ Dry Cough (from reflux to trachea)
- ⑤ Burping.
- ⑥ Waterbrush (Reflux Salivary Hypersecretion)

* Diagnosis: Clinical (start empirical PPI)

1- Endoscopy with Biopsy:

- ① If alarming symptoms (Dysphagia, failure of empiric therapy, GI Bleeding)
- ② Preop evaluation.

2- 24 hours PH monitoring (Gold Standard)

* Management:

① Lifestyle Modification:

- ① Eat frequent small meals.
- ② Avoid fatty, spicy meals
- ③ Elevate head while sleeping.
- ④ Stop smoking

② Medical therapy:

- ① Antacids: Mg hydroxide, Al hydroxide.
- ② Proton Pump Inhibitors: - Prazoles
- ③ H₂ Antagonists: - tidine.
- ④ Prokinetics: Domperidone.

③ Anti-Reflux Surgery:

\Rightarrow Indications \rightarrow failure of medical th.
 \rightarrow Complicated GERD.
 \rightarrow Atypical symptoms

① Laparoscopic Fundoplication

\rightarrow Nissen 360°
 \rightarrow Anterior, Partial (Dor)
 \rightarrow Posteriorly $< 250^\circ$ (Toupet)

② Endoscopic Radiofrequency ablation.

GERD Complications

① Erosive Esophagitis:

- Mucosal Injury with Inflammation.
- Grades: 1- Red mucosa without ulcer
- 2- Linear ulcer that easily Bleed.
- 3- wide ulcer
- 4- strictures

Complicate 15% of GERD.

② Barret Esophagus: Metaplasia of lower portion of esophageal mucosa from Squamous to columnar epithelium. (simple with Goblet cells)

- Z-line become more proximal.

* This Lesion is Premalignant: (very rare & very slow)

- GERD \rightarrow Metaplasia $\xrightarrow{4\%}$ Low Grade Dysplasia
 1% per year \rightarrow High Grade Dysplasia \rightarrow Adenocarcinoma.
 .5% per year \rightarrow Adenocarcinoma. (\uparrow Risk 25 times)

* Management:

- Patients should undergo Endoscopy + Biopsy
- Should take long term PPI's.
- Endoscopic surveillance recommended because: 1) No medication prevent malignant transformation
- 2) Malignancy in Barret curable if detected in early stage.
- Other treatments: 1) Radiofrequency ablation to allow new mucosa formation
- 2) Severe Dysplasia \rightarrow Endoscopic Mucosal Resection
- 3) Invasive \rightarrow staging + Esophagectomy.

③ Strictures:

- fibrotic ring that narrow the lumen.
- Symptoms: Dysphagia (Progressive)
- Diagnosis: Endoscopy.
- Treatment: Dilation.

④ Recurrent Pneumonia:

- from recurrent Aspiration
- Bronchoscopy + Biopsy \rightarrow Lipid Laden macrophages.

* Design

Esophageal Tumors

Benign Tumors & Cysts:

- Are uncommon.
- The most common benign tumor is **leiomyoma (50%)** ⇒ Benign smooth muscle tumor so 90% located in lower 1/3 of Esophagus.
 - ↳ Avg. Age 38.
 - ↳ Don't treat unless there's Dysphagia.
- Cysts ⇒ Could be congenital or Acquired.
 - ⇒ The most common are Enteric or Bronchogenic cyst.

Esophageal Cancer:

- Uncommon, but ↑ Incidence.
 - ↳ Age > 60yrs
 - ↳ Male > females
- In the past Squamous Type was the most common. Nowadays the Adenocarcinoma is more common. (>50% of E. cancer)
- Lethal disease because of late presentation, But survival is increasing due to:
 - ① Better understanding of molecular Biology
 - ② Screening.
 - ③ Surveillance & improved staging.
 - ④ Neoadjuvant therapy.

* Clinical Symptoms: (Late Presentation) ⇒ Lack of serosa allow smooth muscle to dilate

- 1- Progressive Dysphagia → Become severe to seek medical care when >60% of circumference infiltrated.
- 2- weight loss
- 3- Less often: Retrosternal pain, chest pain, back pain (sign of invasion)
- 4- Metastatic Disease: Virchow's Node (Liver), Ascites, Pleural effusion (Lung)

* Investigation:

- ① Endoscopy with Biopsy (Definitive) - Better than Barium because its underdvision.
- ② Endoscopic us (EUS) → Most reliable to determine depth of invasion (Mucosa or submucosa) Visualize LN (even if <1cm which can't be detected by CT)
- ③ CT scan (For Staging)
 - ↳ Next step if Biopsy shows Ca.
- ④ PET scan → Done if CT -ve.

* Treatment:

- If small Ca. confined to Mucosa → Endoscopic Mucosal Resection. (20% have +ve nodes)
- If tumor invade submucosa without LN → Esophagectomy + LN dissection
- If tumor spread through the wall + LN → Neoadjuvant chemo. (Before Surgery)
- If tumor invade adjacent structures → Palliative stenting.

- * Curative Resection → 50 - 70%
- * Operative mortality → 5 - 10%
- * Perioperative Complication → 40%

⇒ Types:

Adenocarcinoma	Squamous Cell Ca.
- Located at distal third of esophagus & GEJ.	- Located in upper 2/3 of Esophagus.
- <u>Caused By:</u> <ol style="list-style-type: none"> ① GERD. ② Barret Esophagus. ③ Smoking, RT 	- <u>Risk factors:</u> <ol style="list-style-type: none"> ① Smoking, Alcohol ② Caustic Injury ③ Plummer vensin Synd ④ Radiation ⑤ Hot Beverage ⑥ Achalasia.
- More in Cucasian males.	- More in Black men.
- Mainly treated by surgery.	- Mainly treated by RT
- Better Prognosis	- worse prognosis.

Types of Esophagectomy

- Trans-Hiatal**
 - Upper midline laparotomy.
- Ivor-Lewis → Trans-thoracic**
 - Laparotomy with right thoracotomy.
 - Direct visualization of thoracic portion & limited lymphadenectomy.
- Blunt dissection of thoracic portion & cervical Anastomosis.
- Drawbacks:
 - 1- Inability to perform full thoracic Node dissection
 - 2- Lack of visualization of midthoracic dissection
- Advantage:
 - 1- lower rate of chyle leaks
 - 2- lower rate of pulmonary complications.