

# **DT SS SURGERY**

**2nd edition (Latest)**



**VOL 2**

**SURGERY GROUP NOTES FOR NEET SS**



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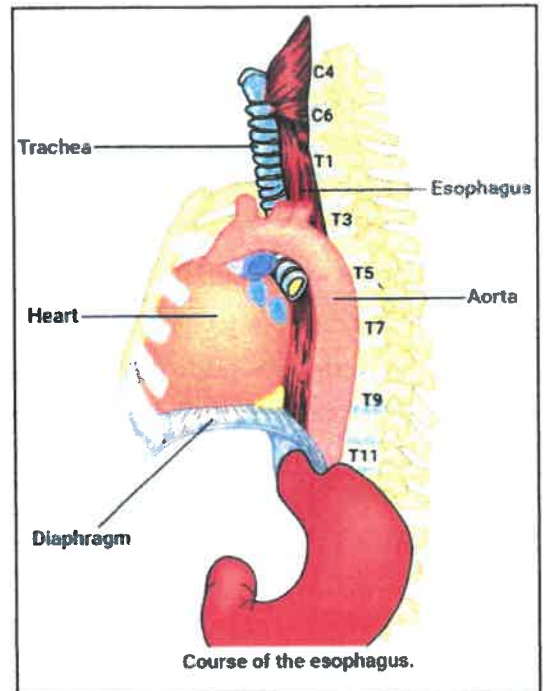
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## ANATOMY

### Anatomy

- It commences at the base of the pharynx at C6 and terminates in the abdomen, where it joins the cardia of the stomach at T11
- It is 25 cm in length
- Cricopharynx is the narrowest part
- Seen 15 cm from incisor teeth
- Cranial esophagus is at left side
- At the level of the carina, it deviates to the right to accommodate the arch of the aorta.
- Then it winds its way back under the left main bronchus.
- Enters the diaphragm at T11

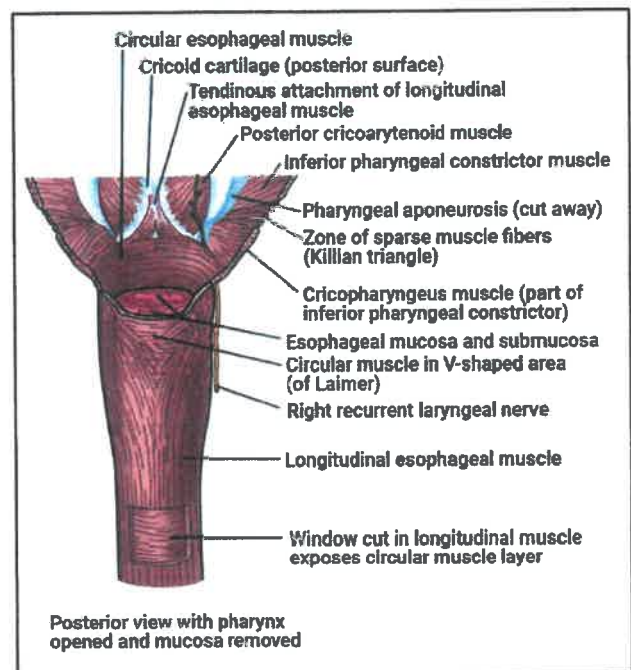


### INI CET SS-2021

- Pharyngeal constrictor muscles are three consecutive muscles. (superior, middle, inferior)
- The inferior constrictor is the final bridge between pharynx and esophageal musculature
- Inferior constrictor is made of two muscles (Oblique) thyropharyngeus and cricopharyngeus transvers
- Potential weakness between these two muscles is known as Killian's dehiscence.
- Killian's dehiscence is defect in inferior constrictor of pharynx

### Esophageal inlet

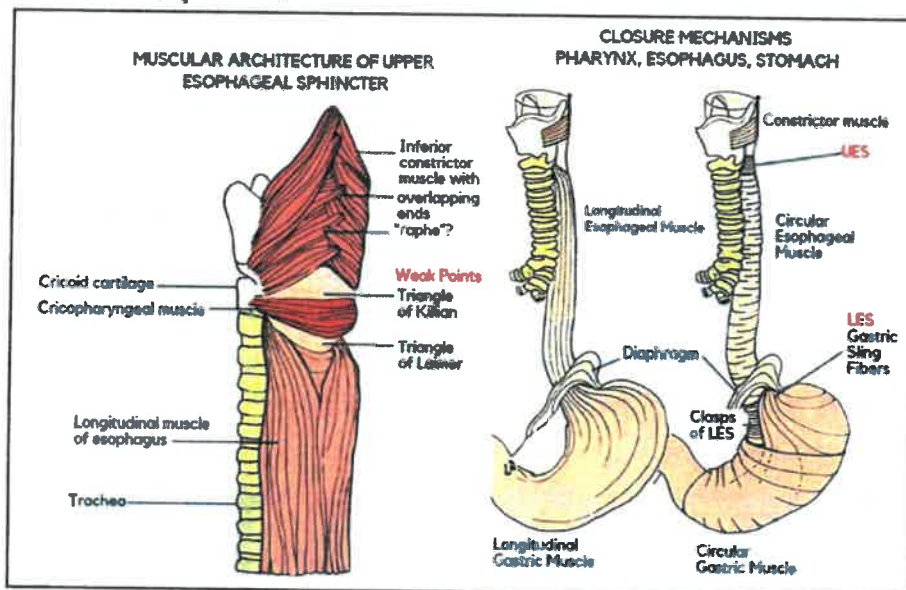
- The crico pharyngeus muscle is responsible for generating a high – pressure zone that marks the position of the UES and esophageal introitus.
- Its distinctive bowing array of muscle fibers is unique and serve to transition into the inner circular esophageal musculature.
- This point of transition is flanked by the longitudinal esophageal muscles that extend superiorly to attach to the midportion of the posterior surface of the cricoid cartilage and form the V-shaped area of Laimer triangle.
- Laimer's triangle defects in longitudinal muscle of esophagus



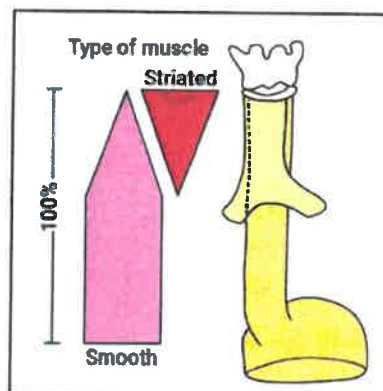
### Muscles in Esophagus

- Consists of striated and smooth muscle
- Inner circular muscle is the extension of cricopharyngeal muscle and traverse through the thoracic cavity into abdomen, where they become middle circular muscle on lesser curvature of stomach.
- Short clasp fibres on lesser curvature, oblique sling fibres on greater curvature
- Collar of Helvetius marks the transition of circular muscles of esophagus to oblique muscles of stomach at incisura (Cardiac notch)-also called as loop of Willis
- Outer longitudinal muscles continue as longitudinal muscles of stomach.
- Upper esophagus more of striated muscle
- First smooth muscle starts, 2-3 cm caudal to ES
- Striated muscle end before tracheal bifurcation

### Collar of Helvetius or loop of Willis



### Striated and smooth muscles



- Distal to tracheal bifurcation there are no striated muscles
- The upper esophagus is made of striated muscles
- The first smooth muscle appear 2-3 mm caudal to UES
- There is gradual change off of the striated muscle to smooth muscle

### Natural constrictions

- Hour glass shape
- Esophagus – 14mm in cricopharyngeal muscle
- Broncho aortic constrictions – at level of T4→15-17 mm
- Aorta at 23 cm, left bronchus at 25 cm
- Diaphragmatic constriction -16-19mm
- Dilated parts of esophagus has-2.5cm diameter

### Bailey says:

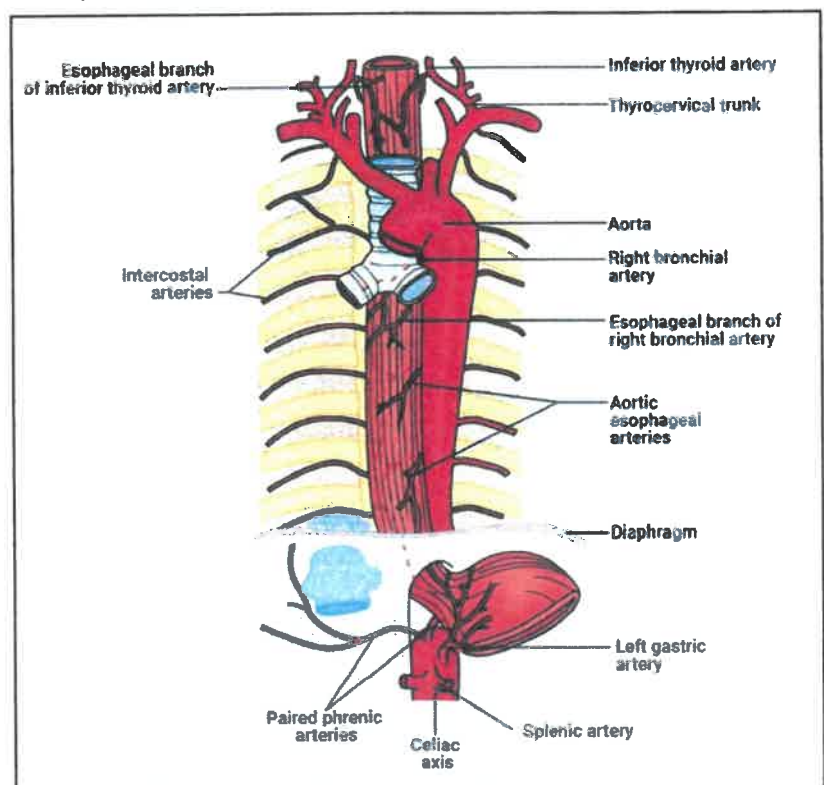
- 15cm – Cricopharynx
- 25cm – Aortic and bronchial
- 40cm – Diaphragmatic sphincter

### Blood supply

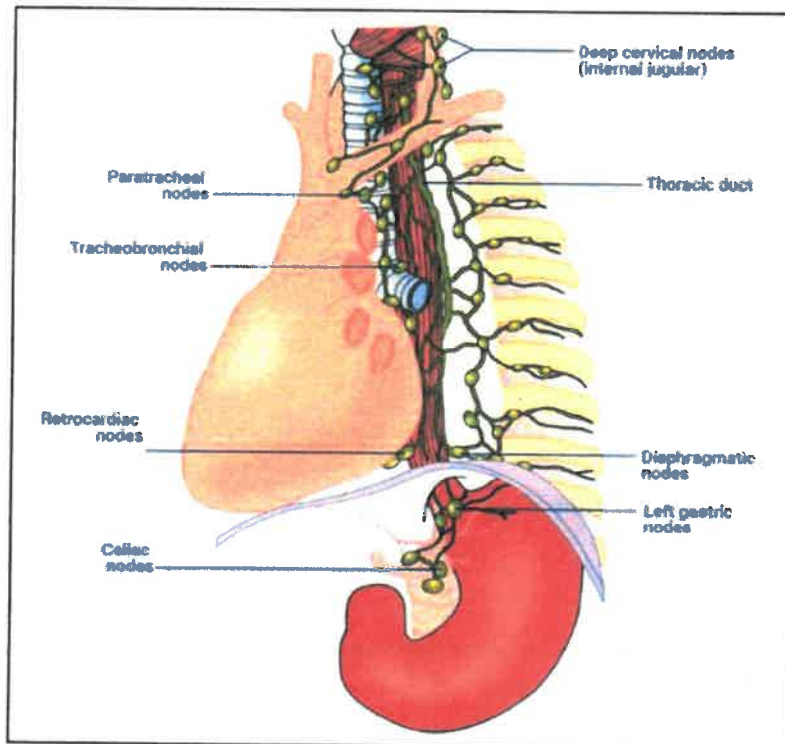
- Cervical esophagus–inferior thyroid artery (TCT on left and SCA on right)
- Cricopharyngeus muscle supplied by STA
- Abdominal part from LGA and inferior phrenic artery
- The thoracic esophagus receives its blood supply directly from four to six esophageal arteries coming off the aorta, as well as esophageal branches off the right and left bronchial arteries.
- It is supplemented by descending branches off the inferior thyroid arteries, intercostal arteries, and ascending branches of the paired inferior phrenic arteries

### Thoracic esophagus

- Branches from:
  - Aorta
  - Bronchial artery
  - Intercostal artery
  - Inferior thyroid artery
  - Ascending branch of inferior phrenic artery
- Form a capillary network before entering muscle layer and again have a capillary network in submucosal layer



## Lymphatic drainage



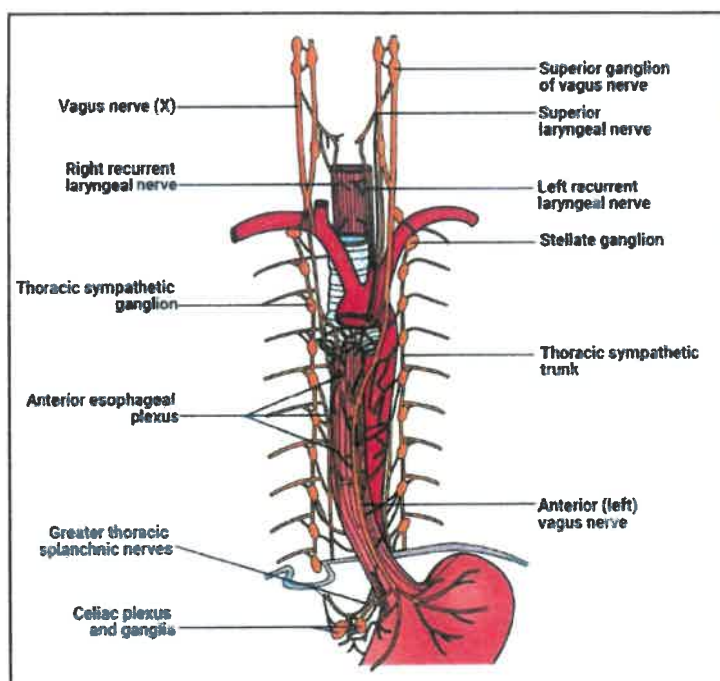
- Submucosal lymphatics penetrate muscularis propria and drain into plexus that runs longitudinally.
- In upper 2/3<sup>rd</sup> esophagus it runs upward (cervical group)
- In lower 1/3<sup>rd</sup> esophagus it runs downward (coeliac nodes)
- In case of tumors in submucosa it can spread through lymphatics by 10 cm. Hence, 10cm margin is given in clearance

## Sympathetic supply of esophagus

- Cervical sympathetic trunk arises from superior ganglion in the neck.
- It extends next to the esophagus into the thoracic cavity, where it terminates in the cervicothoracic (stellate) ganglion.
- Along the way, it gives off branches to the cervical esophagus. The thoracic sympathetic trunk continues on from the stellate ganglion, giving off branches to the esophageal plexus, which envelops the thoracic esophagus anteriorly and posteriorly.
- Inferiorly, the greater and lesser splanchnic nerves innervate the distal thoracic esophagus.
- In the abdomen, the sympathetic fibers lay posteriorly alongside the left gastric artery

### Parasympathetic innervation

- Parasympathetic fibers arise from vagus nerve which gives rise to superior and recurrent laryngeal nerves.
- Right RLN loop underneath the right SCA
- Left RLN loop underneath the Aortic arch.
- Vagus nerve sends fibers in thorax and these fibers along with sympathetic forms a weblike nervous plexus and supply Auerbach and Meissner's plexus.
- The parasympathetic fibers finally coalesce 2cm above diaphragm as left anterior and right posterior vagus nerve



### Physiology of Oesophagus

- The Esophagus usually measure 30cm, extending from the pharynx down onto the cardia of the stomach.
- Primary peristalsis-2-4cm/second. Food reaches LES in 9 seconds.
- Intraluminal pressure created is 40-80 mm Hg
- Secondary peristalsis is caused by irritation and distension
- Tertiary peristalsis are non-progressive, non-peristaltic, monophasic or multiphasic and simultaneous waves. They represent Un coordinated contractions of smooth muscles leading to spasm

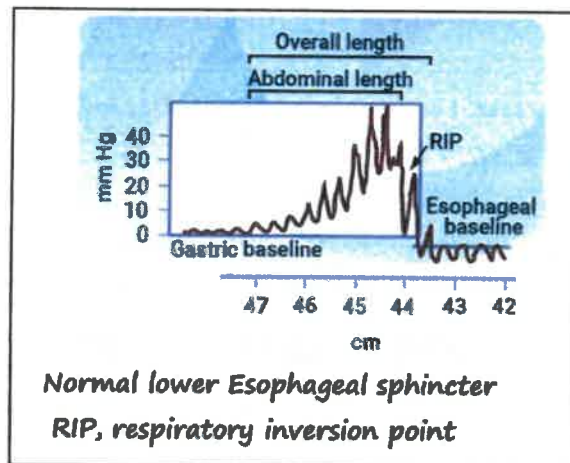
Normal manometric values	
Parameter	Value
Upper esophageal sphincter	
Total length	4.0-5.0cm
Resting pressure	60.0mmHg
Relaxation time	8 sec
Residual pressure	0.7-3.7mm Hg
Lower esophageal sphincter	
Total length	3-5cm
Abdominal length	2-4cm
Resting pressure	6-26mm Hg
Residual pressure	3mmHg
Esophageal body contractions	
Amplitude	40-80mm Hg
Duration	2.3-3.6sec

## Questions from 21<sup>st</sup> sabiston

### Question1

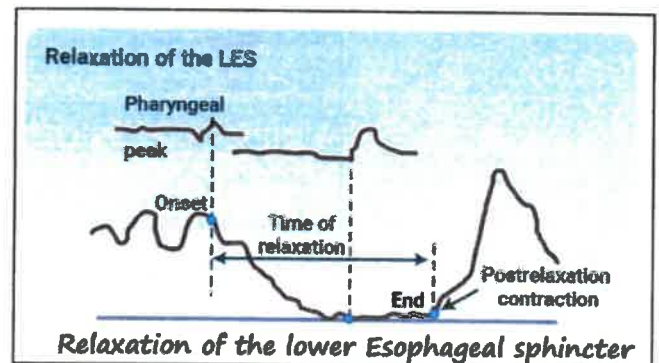
- Respiratory inversion point-false statement is
  - A. It is a manometric tracing
  - B. It stands for transition from intra thoracic sphincter to intra-abdominal sphincter.
  - C. The pressure of esophagus changes from negative to positive during expiration.
  - D. A minimum total intra – abdominal length of at least 2 cm is needed for a normal LES function
- Ans: C
- The final phase of Esophageal bolus transit occurs through the LES.
- Although this is not a true sphincter, there is a distinct high-pressure zone that measures 2 to 5 cm in length and generates a resting pressure of 6 to 26mm Hg.
- The LES is located in the chest and abdomen.
- A minimum total length of 2cm, with at least 1 cm of intraabdominal length, is required for normal LES function.
- The transition from the intrathoracic to the intraabdominal sphincter is noted on a manometric tracing and is known as the respiratory inversion point

### Respiratory inversion Point



### Question2

- Regarding the opening of LES-false statement is:
  - A. Peristaltic contractions alone is enough for opening the LES
  - B. Vagal mediated relaxation occurs for 1.5 to 2.5 seconds after swallowing.
  - C. The relaxation lasts for 4-6 seconds.
  - D. Post relaxation contraction occurs after peristaltic wave is passed out.
- Ans: A

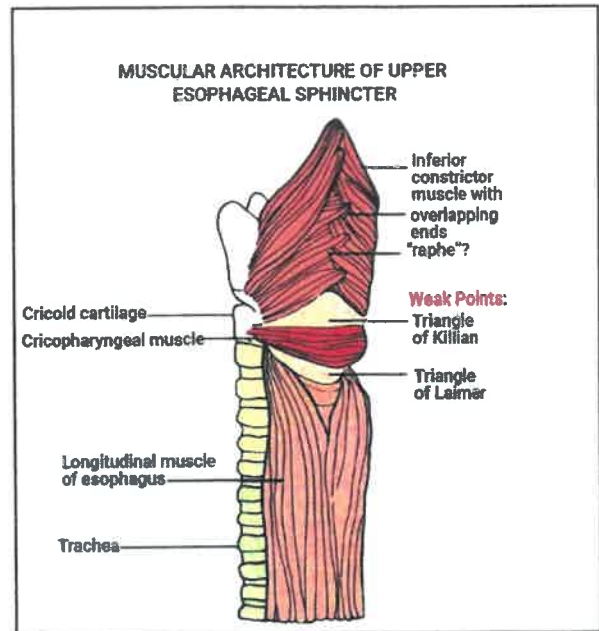


- Peristaltic contractions alone do not generate enough force to open up the LES.
- Vagal – mediated relaxation of the LES occurs 1.5 to 2.5 seconds after pharyngeal swallowing and LASTS 4 to 6 seconds

- A post relaxation contraction of the LESA occurs after the peristaltic wave has passed through the oesophagus, allowing the LES to return to its baseline pressure, re-establishing a barrier to reflux.

### Question 3

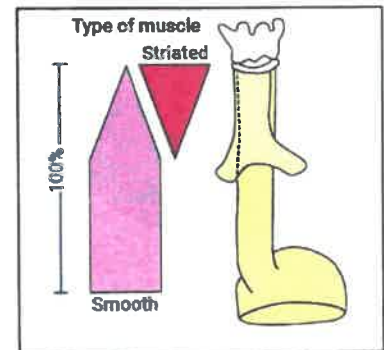
- Laimer triangle is
    - A. Defect between the thyropharyngeal and cricopharyngeal
    - B. Defect in longitudinal muscle layer
    - C. Defect in longitudinal muscle layer
    - D. Defect in inferior constrictor
- Ans: B



### Question 4

- Regarding the muscles of esophagus. True statement is
  - A. Distal to tracheal bifurcation there are no striated muscles
  - B. The upper esophagus is made of striated muscles
  - C. The first smooth muscles fascicles appear 2-3 mm caudal to UES
  - D. There is abrupt change off of the striated muscle to smooth muscle

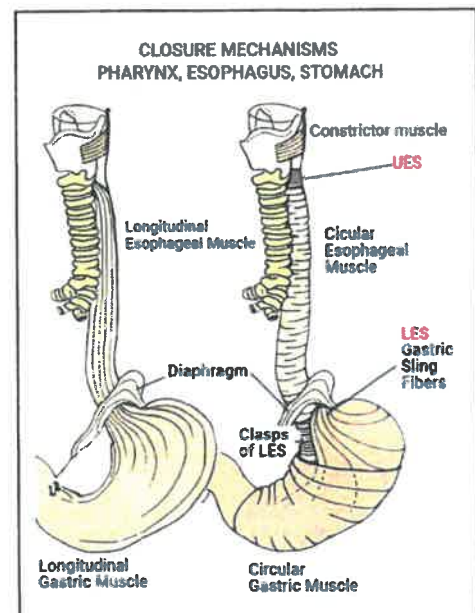
Ans: D



### Question 5

- The false statement regarding the conversion of the muscle layers of esophagus on the gastric muscle layers -
  - A. Longitudinal muscle of esophagus continues as long muscles of stomach
  - B. Circular muscle of esophagus forms short clasps on the lesser curve side
  - C. Circular muscle of esophagus forms gastric Ring fibres on the greater curve side
  - D. None of the above

Ans: D



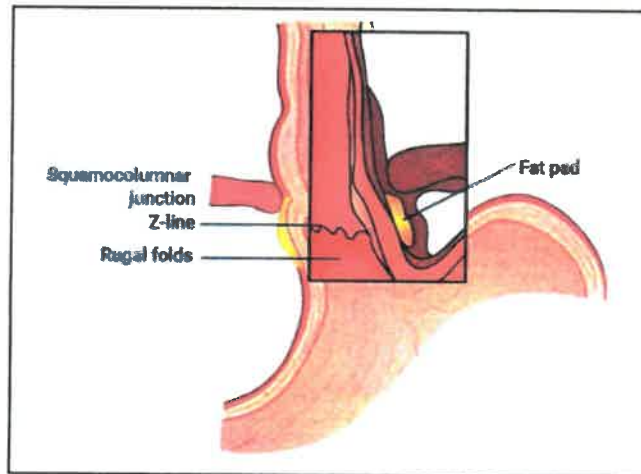
### Question 6

- The following are the markers of GEJ externally except...
  - A. Collar of Helvetius
  - B. Loop of Willis
  - C. Gastroesophageal pad of fat
  - D. Phreno Esophageal membrane

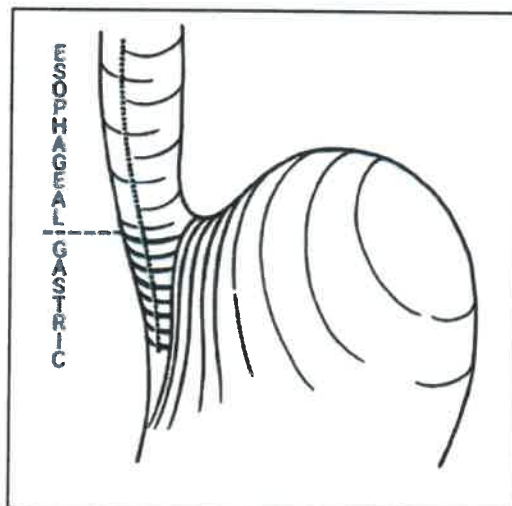
Ans: D (Ref sabiston 21<sup>st</sup> edition page 1016)

- Collar of Helvetius = Loop of Willis is the point where the circular muscle fibres of esophagus join the oblique fibres of stomach

### External markers



### Collar of Helvetius



## PHYSIOLOGY BEHIND MOTILITY DISORDERS

The Chicago classification of esophageal motility, v3.0.

- Amplitude (renamed) = Distal Contractile Integrity (DCI)  
= Amplitude x Duration x cms (mmHg cms)
- Normal DCI= 450 mmHg cms
- LES (RP= 2 to 26 mmHg) = integrated relaxation pressure (IRP)= <15 mmHg

Achalasia and Esophagogastric Junction Outflow Obstruction	
<b>Type 1 Achalasia (Classic)</b> <ul style="list-style-type: none"> <li>• Most common</li> <li>• Hypomotility</li> </ul>	<ul style="list-style-type: none"> <li>• Median IRP &gt;15mm Hg, 100% failed peristalsis (DCI &lt;100mm Hg s.cm); Premature contractions with DCI &lt;450mm Hg.s.cm Satisfy criteria for failed peristalsis</li> </ul>
<b>Type 2 Achalasia (With esophageal compression)</b> <ul style="list-style-type: none"> <li>• HRM Isobaric contour at 30 mmHg</li> </ul>	<ul style="list-style-type: none"> <li>• Median IRP &gt;15mm Hg 100% failed peristalsis, Panesophageal pressurization with ≥20% of swallows</li> <li>• DCI not measurable</li> </ul>
<b>Type 3 Achalasia (Spastic achalasia)</b>	<ul style="list-style-type: none"> <li>• Median IRP &gt;15mm Hg: no normal peristalsis spastic contractions with DCI &gt;450mm Hg.s.cm with 20% ≥Swallows</li> </ul>
<b>Esophagogastric junction outflow obstruction (Achalasia in evolution)</b>	<ul style="list-style-type: none"> <li>• Median IRP &gt;15mm Hg sufficient evidence of peristalsis such that criteria for type 1-3 are not met</li> </ul>
Major disorders of peristalsis	
<b>Absent contractility</b> <b>Distal esophageal spasm</b> <b>Hypercontractile esophagus (Nutcracker or Jackhammer)</b> <b>Hypermotility</b>	<ul style="list-style-type: none"> <li>• Normal median IRP, 100% failed peristalsis</li> <li>• Normal median IRP, ≥20% premature, tertiary peristalsis contraction with DCI &gt;450mm Hg-s-cm</li> <li>• At least 2 swallows with DCI &gt;8000mm Hg.s.cm</li> </ul>
Minor disorder peristalsis	
<b>Ineffective esophageal motility</b> <b>Fragmented peristalsis</b>	<ul style="list-style-type: none"> <li>• ≥50% ineffective swallows</li> <li>• ≥50% fragmented contractions with DCI &gt;450mm Hg.s.cm</li> </ul>
<b>Non esophageal motility</b>	<ul style="list-style-type: none"> <li>• None of the above criteria are met</li> </ul>

- Conventional manometry used sensors 5 cm apart
- High resolution manometry used 36 sensors 1 cm apart
- HRM gives topography plots

### Question 1

- Regarding HRM; False statement is
  - a. In conventional manometry pressure sensors are kept at a distance of 3-5 cm
  - b. In HRM pressure sensors are kept at a distance <1 cm in longitudinal direction only.

- c. We use up to 36 sensors in HRM
- d. Three-dimensional spatial pressure map drawn during deglutition.

Ans. c

- From a practical standpoint, the primary difference between HRM and conventional manometry is that in HRM, the pressure sensors are no more than 1 cm apart rather than every 3 to 5 cm.
- Up to 36 sensors can be found distributed radially and longitudinally, allowing a three-dimensional spatial pressure map to be drawn during deglutition.
- The graphic representation of this is what is referred to as esophageal pressure topography.

#### Diffuse Esophageal Spasm

- MC in women
- 5 times less common
- Basic pathology is a motor abnormality in body of esophagus, most notable in lower 2/3rd. Muscular hypertrophy and Vagus nerve branches degeneration is noted.
- DES hence shows- Repetitive (Mirrored), Simultaneous and High Amplitude Contractions.

#### Question 2

- False about DES is (NBE Repeat Question)
  - a. Most common in women
  - b. Presents with complaints of squeezing pressure in Chest that may radiate to jaw, arms and upper back
  - c. Acid reflux is more common
  - d. Regurgitation of Esophageal contents and saliva is common
  - e. Symptoms aggravated by emotional stress

Ans. c (Acid reflux is less common) Ref. Page 1023, 21st edition

- Patients will complain of a squeezing pressure in the chest that may radiate to the jaw, arms, and upper back.
- The symptoms are often pronounced during times of heightened emotional stress.
- Regurgitation of Esophageal contents and saliva is common, but acid reflux is not
- However, acid reflux can aggravate the symptoms, as can cold liquids.
- May be associated with Functional GI symptoms—such as irritable bowel syndrome and Pyloric Spasm may accompany DES.
- Also remember other GI problems like Gall stones, Pancreatitis and Peptic ulcer can all trigger DES.

#### HRM in DES

- Normal median IRP
- >20% premature contractions of LES.
- DCI is greater than 450 mmHg Cm S
- Correlation of subjective complaints with evidence of spasm (induced by Vagomimetic drug like Bethanechol) on manometric tracing is convincing evidence of this disease.

### Management of DES

- Nitrates, calcium channel blockers, sedatives, and anticholinergics may be effective in some cases, but the relative efficacy of these medicines is not known.
- If acid reflux is a component- Acid suppression medications may be helpful\*\*
- Peppermint may also provide temporary symptomatic relief.
- Bougie dilatation of the esophagus up to 50 or 60 Fr provides relief for severe dysphagia and is 70% to 80% effective.
- Botulinum toxin injections have also been tried with some success, but the results are not sustainable

### ? Long Esophago myotomy

- Historically, a long esophagomyotomy is performed either through the abdomen or a left thoracotomy or video-assisted thoracoscopic approach in the chest is used.
- While some surgeons advocate extending the myotomy up into the thoracic inlet, most agree that the proximal extent generally should be high enough to encompass the entire length of the abnormal motility, as determined by manometric measurements.
- The distal extent of the myotomy is extended down onto the LES, but the need to include the stomach is not agreed on uniformly.
- A Dor fundoplication is recommended to provide reflux protection as the surgery itself interrupts the phrenoesophageal ligament and encourages reflux.
- Results of a long esophagomyotomy for DES are variable, but it is reported to provide relief of symptoms in up to 80% of patients

### Changed Concept in management in 21st Edition

- Recently, several authors have reported their experience with the use of peroral endoscopic myotomy (POEM) in the treatment of motility disorders of the esophageal body.
- Clinical response rate = 93%

### NUT CRACKER Esophagus

- All ages equally seen
- Equal in male and female
- MC hypermotility disorder
- Most painful of all Esophageal motility disorders
- Dysphagia+ Chest pain is seen
- Odynophagia is also noted
- Regurgitation and Reflux are UNCOMMON\*\*

### Barium swallow

- Diffuse Esophageal Spasm
- Nut cracker esophagus can show cork screw in Barium swallow
- Epiphrenic diverticulum can also be seen



### *Nutcracker esophagus*

- An esophagram may or may not reveal any abnormalities, depending on how well “behaved” the esophagus is during the examination.

### *HRM in NCE*

- Subjective complaint of Chest pain with at least 2 swallows showing a DCI > 8000 mmHg cms.
- LES is normal
- Relaxation occurs with every wet swallow
- Ambulatory monitoring helps to distinguish this disorder from DES.

### *Medical treatment of NCE*

- Similar to DES, the primary initial treatment of nutcracker esophagus is medical.
- Calcium channel blockers, nitrates, and antispasmodics may offer temporary relief during acute spasms.
- Bougie dilatation may offer some temporary relief of severe discomfort but has no long-term benefits

### *Nutcracker esophagus*

- Ambulatory monitoring can help distinguish this disorder from DES.
- This is of critical importance because a subset of DES patients with dysphagia can be helped with esophagomyotomy, but surgery is of questionable value in patients with a nutcracker esophagus.
- Patients with nutcracker esophagus may have triggers and are counselled to avoid caffeine, cold, and hot foods.
- Although surgery was not historically included in the management of this disease, early results from POEM demonstrating excellent clinical responses.

## ACHALASIA CARDIA

- Coined by Hurst – “Failure to relax”

### Basics

- 6/1 lakh population
- MC in young women
- Classic Triad- DYSPHAGIA+ REGURGITATION+ WEIGHT LOSS
- Heart burn, Choking and nocturnal Coughing are common
- Eat slowly and drink plenty of water.
- Severe pain is experienced until the LES opens and food enters stomach.
- Slow Progressive dysphagia\*\*

### Complications

- Regurgitation of undigested, foul smelling food particles is common
- Aspiration can become life threatening
- Pneumonia, lung abscess and bronchiectasis
- In 20 years, 8% chance of developing SCC seen where the undigested food particles cause mucosal irritation in Body of esophagus
- Even in patients treated with Achalasia there is ongoing cancer incidence risk is there. (Long term surveillance is advised but as of now no such program is available)

### Question

- What is the most common site of Adenocarcinoma in Achalasia cardia? (NBE repeat)
    - a. Lower 1/3rd
    - b. Upper 1/3rd esophagus
    - c. Above air fluid level in middle of esophagus
    - d. Below air fluid level in middle 1/3rd esophagus
- Ans. D (Ref Sabiston 21st edition page 1026)

### Esophagogram findings

1. Most common – Barium Swallow
  - Findings
    - a. Classical Bird beak
    - b. Pencil tip
    - c. Hurst Phenomenon
    - d. Abrupt cut off contrast
  - Lack of peristaltic waves in Body and failure of LES to open is seen.
  - Lack of gastric air bubble is a common finding in Upright portion of Esophagogram.
  - Megaesophagus (tortuous/ Sigmoid Esophagus)

### Hurst Phenomenon

- Hurst Phenomenon--temporary transit through cardia provoked by hydrostatic pressure of barium column reaching above a critical level
2. X- Ray
    - Findings
      - a. Retrocardiac air fluid level
      - b. Absent of fundus gas shadow

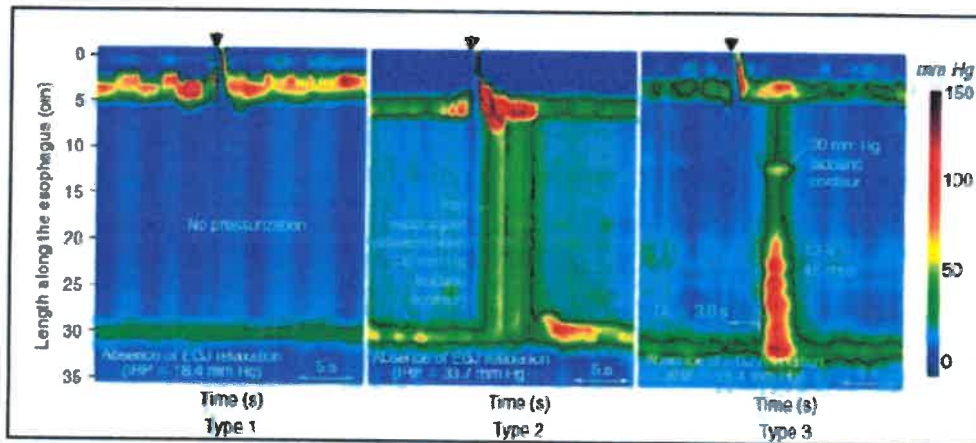


Achalasia Cardia

### Manometry tracings of Achalasia Types

- In type I (classic) achalasia, the median IRP greater than 15 mm Hg and there is 100% failed peristalsis with minimal esophageal pressurization.
- In type II achalasia, the median IRP greater than 15 mm Hg, 100% failed peristalsis, and panesophageal pressurization with at least 20% of swallows.
- In type III (spastic or vigorous) achalasia, the median IRP greater than 15 mm Hg without normal peristalsis and there are spastic contractions (distal contractile integral >450 mm Hg·s·cm) with at least 20% of swallows. Bailey says- Panesophageal pressurisation may be seen.

### Banding at 30 mmHg



### Endoscopy

- To look for Esophageal mucosal damage
- To look for secondary causes of Esophageal narrowing (Pseudoachalasia)- GEJ tumors, Neuropathy, Strictures.

### Question

- False statement regarding the treatment of Achalasia cardia is
  - a. Sublingual CCB, Nitroglycerine and Nitrates provide hours of relief before and after meals.
  - b. Botox may offer symptomatic relief for years but symptoms recur within six months in more than 50%
  - c. Pneumatic Balloon dilatation provides 89% remission of symptom compared to Botox which provides 38% remission in 1 year.
  - d. Balloon dilatation and Surgical treatments are curative for Achalasia cardia.

Ans. D

- There are surgical and nonsurgical treatment options for patients with achalasia; all are directed toward relieving the obstruction caused by the LES.
- Because none of them are able to address the issue of decreased motility in the esophageal body, they are all palliative treatments.

### Achalasia Management- Changed points

- In comparing balloon dilatation to Botox injections, remission of symptoms occurred in 89% versus 38% of patients at one year, respectively
- Balloon dilatation response rate of 89% at 1 year

- 25% may need re-dilatation
- Studies done to compare balloon dilatation versus surgery have shown perforation rates of 4% -5% and mortality rates of 0.5% and 0.2%, respectively.
- However, in a randomized controlled trial of the European Achalasia Trial Investigators, pneumatic dilatation was found to be equivalent to Laparoscopic Heller myotomy and Dor fundoplication with therapeutic success rates of 86% versus 90% at two years.
- Modified Heller's myotomy cut - 1-2 cm below OG junction and 6-8 cm above OG junction
- Perforation occurred in 4% of the patients during pneumatic dilatations and mucosal tears occurred in 12% during laparoscopic Heller myotomy, but all were repaired intraoperatively.
- Notably, patients in the pneumatic dilatation cohort had a 25% rate of re dilation to achieve treatment success.
- POEM is gold standard for type III achalasia

#### Sabiston 21st Edition Question

- Regarding esophagectomy for Sigmoid mega esophagus - False statement is:
    - a. Indicated for cases where there is failure of more than 1 myotomy.
    - b. Indicated for cases with reflux stricture not amenable for dilatation.
    - c. Transhiatal esophagectomy with or without vagus preservation is done for end stage Achalasia.
    - d. In mega esophagus- transthoracic esophagectomy is advised.
    - e. POEM is not beneficial in End stage achalasia
- Ans. E (Sabiston 21st Edition Page 1028)

#### Megaesophagus (sigmoid Megaesophagus)

- Esophagectomy is considered in any symptomatic patient with a tortuous dilated esophagus (megaesophagus), sigmoid esophagus, failure of more than one myotomy, or reflux stricture that is not amenable to dilatation.
- A transhiatal esophagectomy with or without preservation of the vagus nerve offers a good long-term result in end stage Achalasia
- However, in the setting of megaesophagus, a total esophagectomy incorporating a transthoracic dissection may be safest, given the difficulty in palpating the borders of the esophagus through a transhiatal approach.
- In a recent study, two-year outcomes after POEM demonstrated treatment success in 96.8% of patients. Use of POEM may obviate the need for esophagectomy in this malnourished, often high-risk, patient population.

#### Sabiston 21st Edition update

- The best treatment for Ineffective Esophageal Motility is
    - a. Heller Myotomy
    - b. Pneumatic Dilatation
    - c. Effective treatment of GERD
    - d. CCB
- Ans. C (Ans. E Sabiston 21st Edition Page 1028)

### POEM for Achalasia

- Via a submucosal tunnel- Myotomy done.
- The major concerns are – Lack of anti-reflux procedure and increased incidence of Symptomatic reflux.
- As of now short-term outcomes are comparable to Heller myotomy, Long term results awaited.

### POEM



### Eckardt Scoring?

- Post Treatment Scoring for Achalasia Cardia
- Score more than 3 is failure of treatment
- Total Score = 12
- Mnemonic- "Regurgitate PWD"

Score	Symptom			
	Weight loss	Dysphagia	Retrosternal pain	Regurgitation
0	None	None	None	None
1	<5kg	Occasional	Occasional	Occasional
2	5-10kg	Daily	Daily	Daily
3	>10kg	Each meal	Several times a day	Each meal

### Ineffective Esophageal motility

- It is defined as a contraction abnormality of the distal esophagus and is usually associated with GERD.
- It may be secondary to inflammatory injury of the esophageal body because of increased exposure to gastric contents
- Dampened Motility of Esophageal body results in poor acid clearance in distal esophagus
- Symptoms are usually mixed but patients presents with Reflux and Dysphagia.
- IEM is defined by greater than 50% of swallows being deemed ineffective (distal contractile integral <450 mm Hg·s·cm).
- The best treatment of IEM is prevention, which is associated with effective treatment of GERD.
- Scleroderma may manifest as IEM in HRM and best treated by addressing the underlying condition.

## DIVERTICULUM IN ESOPHAGUS

- Zenker's diverticulum also known as pharyngeal pouch
- Most commonly seen in old males
- Most commonly seen in left side of neck
- Most common symptom – stickiness in throat
- It is a false diverticulum

### Question: 01

- False statement about Zenker's Diverticulum:
  - A. Most common Esophageal diverticulum found today is Zenker
  - B. Most common on left side in old men around 70 years age
  - C. Nagging cough is a sign of early disease
  - D. Lateral view of Barium is the IOC
  - E. Endoscopy and Manometry are not needed in investigation of Zenker's diverticulum

### Answer: C

- Until the Zenker's diverticulum begins to enlarge, patients are often initially asymptomatic.
- Commonly, patients complain of a sticking in the throat.
- A nagging cough, excessive salivation, and intermittent dysphagia often are signs of progressive disease.
- As the sac increases in size, regurgitation of foul-smelling, undigested material is common.
- Halitosis, voice changes, retrosternal pain, and respiratory infections are especially common in older adults.
- The most serious complication from an untreated Zenker diverticulum is aspiration pneumonia or lung abscess.
- In an older patient, this can be morbid and sometimes fatal

### BARIUM SWALLOW- IOC



### Open Repairs

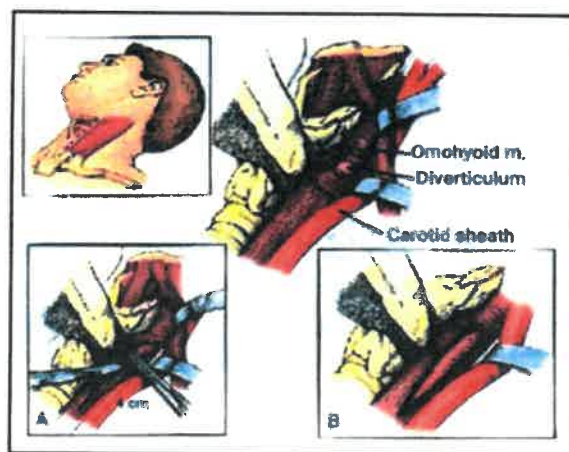
- Two types of open repair are performed: resection or surgical fixation of the diverticulum.
- The diverticulectomy and diverticulopexy are performed through an incision in the left side of the neck.
- In all cases, a myotomy of the proximal and distal thyropharyngeus and cricopharyngeus muscles is performed

### DIVERTICULUM Surgery Sizes

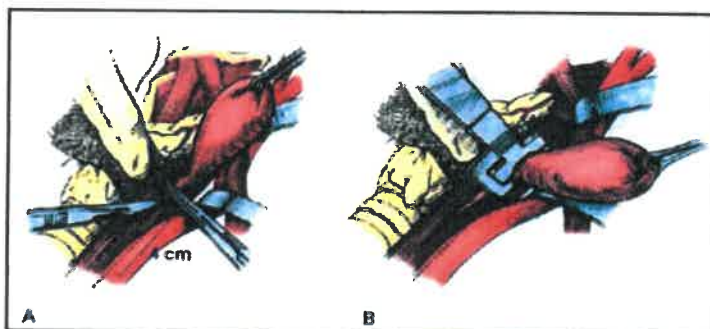
- Small diverticulum (<2 cm)- a myotomy alone is often sufficient.
- In most patients with good tissue or a large sac (>5cm), excision of the sac is indicated.
- Should a diverticulopexy be performed, it is important to suture the diverticulum to the posterior pharynx as opposed to the prevertebral fascia to allow free vertical movement of the pharynx during deglutition.
- The postoperative stay is approximately 2 or 3 days, during which the patient remains unable to eat or to drink.

### Endoscopic Dohlman Procedure

- Biweeerda diverticulosopic is used
- Endoscopic Division of the common wall between the Diverticulum and Esophagus using a Laser, Electrocautery, Stapler has been successful.
- This approach is advised only for Diverticulum size > 3cm size only.
- This procedure needs maximum extension of neck, hence not able to perform in older patients with Cervical stenosis, <3cm size, trismus
- Newer advance is Flexible scopy with needle knife for myotomy. These patients need only one night stay and liquids started the next day. This is advised for patients from 2-5 cm diverticulum.



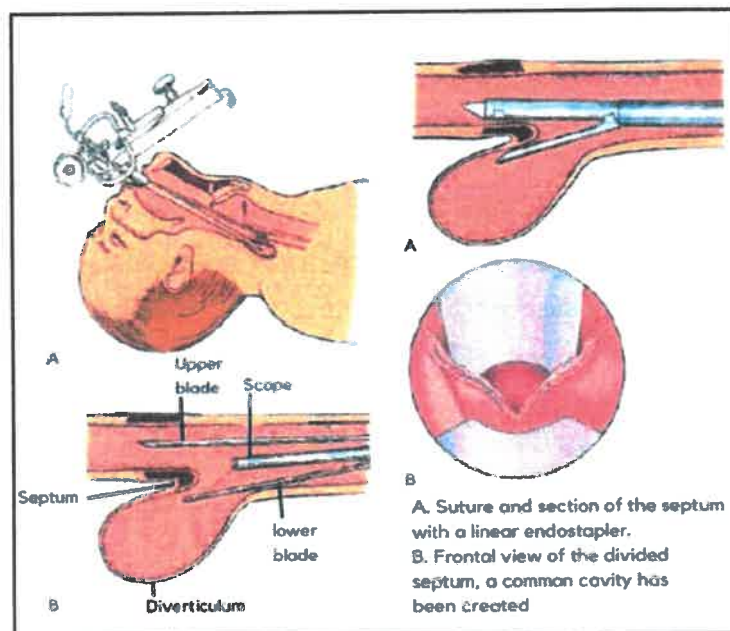
### Medium sized diverticulum



## Diverticulectomy



## Weerda diverticuloscope



### Question: 02

- False statement regarding Mid Esophageal Diverticulum
  - MC cause is Histoplasmosis
  - MC on right side
  - <2cm diverticulum no surgery needed.
  - If surgery is done, Diverticulopexy is not preferred and Diverticulectomy is safer.

Answer: D

### Mid Esophageal Diverticula

- Historically mediastinal nodes due to TB is the common cause.
- Infections with histoplasmosis and resultant mediastinitis have become more common now.
- Results in Traction and True diverticulum in Esophagus.
- THESE MID ESOPHAGEAL DIVERTICULUM IS ALSO ASSOCIATED WITH PRIMARY MOTILITY DISORDER.
- If associated with motility disorders it is a false diverticulum

### Clinical features

- Asymptomatic mostly
- Dysphagia. Chest pain and regurgitation may be seen are actually symptoms of underlying motility disorder.
  - Broncho Esophageal fistula can present with chronic cough
  - Haemoptysis rarely seen due to nodal erosions into vessels.
- They are MC to the right.

### Investigations

- IOC is Barium esophagogram
- CT scan is needed to identify any mediastinal adenopathy.
- Endoscopy is must to rule out malignancy and fistula
- Manometry is must in all cases whether symptomatic or asymptomatic.

### Treatment

- Treat the underlying cause is enough for asymptomatic diverticulum.
- <2cm - Observation is enough
- Symptomatic or >2cm - Surgery advised.
- Usually, the diverticulum has wide mouth and lie close to the spine and hence we do diverticulopexy; diverticulum suspended from Thoracic Vertebral Fascia.
- Alternatively, a diverticulectomy may be performed with care not to narrow the lumen of esophagus.
- Long esophago-myotomy is indicated for patients with chest pain and dysphagia and documented. motility disorder.

### Question: 03

- Epiphrenic Diverticulum - False statement is
  - A. Ehler Danlos syndrome can cause this
  - B. Barium swallow is the 100
  - C. <2cm size diverticulum is suspended from Vertebral fascia
  - D. If diverticulectomy is performed, a long myotomy is performed on the same side of Esophageal wall upto LES

Answer: D

### Epiphrenic Diverticulum

- Most commonly caused by motility disorders - DES, achalasia, NCE
- Found in distal third of esophagus, within 10 cm of GEJ
- Most often related to Thickened Distal Esophageal musculature or increased intraluminal pressure.
- They are PULSION or FALSE - often associated with EDS, Achalasia and Hypertensive LES.
- Most common on right side and tend to be wide. Mouthed
- If not, motility disorders rule out trauma, EDS

### Features

- Asymptomatic mostly
- May present with Chest pain and Dysphagia (feature of underlying motility disorder)
- Diverticulum is found out incidentally while working out for a motility disorder.
- Other C/F- Epigastric pain, weight loss, Chronic cough, Halitosis- all indicate advanced, motility abnormality resulting in a sizeable Diverticulum

### Management

- IOC to diagnose is Barium Swallow
- Manometric studies undertaken
- Endoscopy also done to rule out Barret's and cancer.
- <2cm diverticulum can be suspended from vertebral fascia and need not be excised.
- Perform Myotomy in all such cases from neck of diverticulum extending upto LES.

### Diverticulectomy

- If diverticulectomy is performed, A bougie is kept to avoid narrowing.
- Also close the muscle at that place and perform long myotomy on opposite side.
- If Hiatal Hernia is present that is also repaired
- Failure to repair hernia will result in severe reflux

	Zenker	Traction (mild)	Epiphrenic (Pulsion)
<2cm	Myotomy	No Rx	Diverticulopexy
2-5cm	Endoscopic stapling	Diverticulopexy to pre-vertebral fascia	Diverticulectomy (Keeping a bougie and doing a long esophageal myotomy on opposite side)
>3cm	Dohlman	Diverticulectomy	
2-5cm or more	Diverticulectomy or Diverticulopexy to post pharyngeal wall		

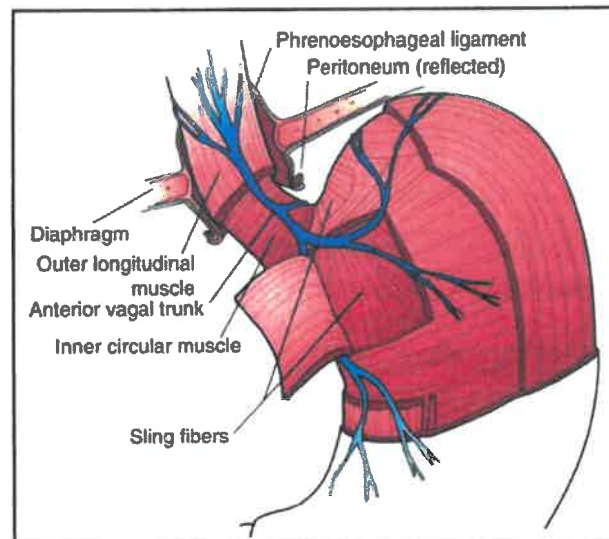
**GERD**

Prevalence of Symptoms in Gastroesophageal Reflux Disease*	
SYMPTOM	PREDOMINANCE (%)
M.C symptoms	80
Heartburn	
Regurgitation	54
Abdominal pain	29
Cough	27
Dysphagia for solids	23
Hoarseness	21
Belching	15
Bloating	15
Aspiration	14
Wheezing	7
Globus	4
<i>"In more than 1000 patients evaluated. Symptoms reported occurred more frequently than once a week.</i>	

Extraesophageal symptoms of gastroesophageal reflux disease.
<b>Laryngeal Symptoms of Reflux</b>
Hoarseness or dysphonia
Throat clearing
Throat pain
Globus
Choking
Postnasal drip
Laryngeal and tracheal stenosis
Laryngospasm
Contact ulcers
<b>Pulmonary Symptoms of Reflux</b>
Cough
Shortness of breath
Wheezing
Pulmonary disease (asthma, idiopathic pulmonary fibrosis, chronic bronchitis, and others)

**LES – made up of 4 factors**

1. Intrinsic musculature of distal esophagus
2. Sling fibres of Gastric Cardia
3. Crura of Diaphragm
4. Increased intra-abdominal pressure is transmitted to GEJ
5. Increased intra-abdominal length of esophagus most common mechanism to prevent reflux



**Question: 01**

- The three typical Esophageal symptoms of GERD are following except
    - Heart burn
    - Retrosternal pain
    - Regurgitation
    - Water Brash
- Answer: B**

**Sabiston says-**

- Heartburn, regurgitation, and water brash are the three typical esophageal symptoms of GERD.
- Heartburn and regurgitation are the most common presenting symptoms.
- Heartburn is specific to GERD and described as an epigastric or retrosternal caustic or stinging sensation, no pressure symptoms
- Typically, it does not radiate to the back and is not described as a pressure sensation, which are more characteristic of pancreatitis and acute coronary syndrome, respectively.

Gerd symptoms		
Typical	Atypical	Extraesophageal
Heartburn	Dyspepsia	Chronic cough
Regurgitation	Epigastric pain	Asthma
Dysphagia	Nausea	Throat clearing
Chest pain	Bloating	Laryngitis
Water brash	Belching	

**Regurgitation**

- Regurgitation of Gastric contents to oropharynx can produce a sour taste.
- Regurgitation of undigested food particles is never seen in GERD and you must rule out Achalasia or Diverticulum.

### Extra Esophageal Symptoms

- First, proximal esophageal reflux and microaspiration of gastroduodenal contents cause direct caustic injury to the larynx and lower respiratory tract; this is the most common mechanism.
- Second, distal esophageal acid exposure triggers a vagal nerve reflex that results in bronchospasm and cough. The latter mechanism is due to the common vagal innervation of the trachea and esophagus.

### Management of Extra Esophageal symptoms

- PPI therapy will suppress gastric acid production, but micro aspiration of nonacid refluxate, which contains caustic bile salts and pepsin, can cause ongoing injury and symptoms.
- Therefore, in patients with extra esophageal symptoms of GERD, a mechanical barrier to reflux (i.e., esophagogastric fundoplication) may be necessary to prevent ongoing laryngeal, tracheal, or bronchial injury.
- Patients with extra esophageal symptoms LARS is must

### Sabiston 21st edition update

- False regarding Idiopathic Pulmonary Fibrosis is
  - A. Chronic progressive lung disease resulting in death in 5 years
  - B. Incidence of GERD in IPF patients is 94%
  - C. Since medical treatment for GERD with PPI doesn't slower the pulmonary decline - Anti reflux surgery is preferred.
  - D. WRAP- IPF trial used Forced Vital capacity as primary end point after fundoplication at 48 weeks.

Answer: B

### Idiopathic pulmonary fibrosis

- Idiopathic pulmonary fibrosis (IPF) is a severe, chronic, and progressive lung disease that generally results in death within 5 years of diagnosis.
- The incidence of GERD in patients with IPF has been reported to be as high as 94%.
- Medical treatment of GERD in patients with IPF is associated with longer survival and slower pulmonary decline.
- PPI therapy does not prevent reflux of nonacid gastro duodenal contents, which may contribute to ongoing pulmonary injury in patients.

### WRAP- IPF trial

- Laparoscopic antireflux surgery for the treatment of idiopathic pulmonary fibrosis (WRAP-IPF) is a multicenter controlled phase 2 trial and the only randomized study comparing LARS to PPI therapy in patients with IPF and GERD confirmed by 24-hour pH probe
- The primary endpoint was change in forced vital capacity (FVC) at 48 weeks of treatment.
- Even in this patient population with severe systemic disease, LARS was deemed generally safe and well tolerated
- Furthermore, the surgery group showed less pulmonary disease progression as measured by 10% FVC decline, acute exacerbation, or death ( $P = 0.048$ ).