Anatomy, Physiology and Benign Disorders of the Esophagus

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Esophagus

- Muscular tube whose primary function is to convey swallowed material from the mouth to stomach
- 25cm in length
  - Measured from its origin in the neck just below the cricoid cartilage
Upper Esophageal Sphincter

- Separates the pharynx from esophagus
- 3 cm in length
- Three skeletal muscle groups
  - Inferior constrictor
  - Cricopharyngeus
  - Proximal esophagus
Diaphragmatic Hiatus

- The esophagus passes from chest into abdomen through the diaphragmatic hiatus
  - Opening in right crus of the diaphragm

- Approximately 2cm of the distal esophagus normally lie within the abdomen
Lower Esophageal Sphincter

- **3cm in length**
- **External**
  - Skeletal muscle of crural diaphragm
- **Internal**
  - Smooth muscle of distal esophagus
Hiatal Hernia

- Displacement of the internal LES from the crural diaphragm into the chest
Indentations of Esophagus

- Aortic arch
  - pulsating
  - 23 cm from incisor teeth
- Left bronchus
  - 25 cm from incisor teeth
- Left atrium
  - 30 cm from incisor teeth
Pathology of Esophagus

- Esophagus is lined almost entirely by stratified squamous epithelium
Z Line

- Junction between esophageal squamous epithelium and gastric-type columnar epithelium

- 1 cm below the sphincter’s proximal border
Anatomic Layers of Esophageal Wall

- Innermost mucosa (hyperechoic)
- Muscularis mucosa (hypoechoic)
- Submucosa (hyperechoic)
- Muscularis propria (hypoechoic)
- Adventitia (hyperechoic)
Muscles of Esophagus

- **Outer layer of longitudinal muscle**
  - Contraction causes the esophagus to shorten

- **Inner layer circular muscle**
  - Responsible for squeezing motion that affects peristalsis and closure of esophageal sphincters
Innervation of Esophagus

Proximal 1/3 of the esophagus

- Striated muscle
- Innervated by efferent fibers (vagus nerve)
- The cell bodies are located in nucleus ambiguus
- The nerves terminate directly on striated muscle cells with cholinergic (nicotinic) receptors
Innervation of Esophagus

Distal 2/3 of the esophagus
- Smooth muscle

Vagus nerve carries the preganglionic fibers of neurons located in the dorsal motor nucleus

The preganglionic fibers supply effector neurons located within the wall of esophagus
Innervation of Esophagus

- The preganglionic fibers terminate on effector neurons

- **Effector Neurons**
  - **Excitatory**
    - Excites the smooth muscle
    - Releasing: Ach
  - **Inhibitory**
    - Inhibits the smooth muscle
    - Releasing: NO, VIP
As a result of this arrangement, the proximal esophagus is subject to diseases that affect striated muscle and its central nervous system innervation

- Polymyositis
- Myasthenia gravis

Distal esophagus is susceptible to diseases of smooth muscle and enteric neurons

- Scleroderma
- Achalasia
Innervation of Esophagus

- The esophagus, at baseline, is in a contractile state

- Peristalsis
  - net result of the coordinated relaxation and contraction mediated by the inhibitory and excitatory myenteric plexus neurons along the length of the esophagus
Innervation of Esophagus

- **UES**
  - Striated muscle
  - Depends on tonic excitation to maintain contractility
  - If innervation lost = flaccid

- **LES**
  - Smooth muscle
  - Inhibitory and excitatory effector neurons in myenteric plexus
  - Achalasia
    - Loss of NO and VIP releasing inhibitory neurons
    - Failure of LES relaxation
Embryology

- In the developing fetus the upper GI and respiratory tract develop from a common tube.

- By gestational week 4 this tube develops a diverticulum on its ventral surface.

- This diverticulum subsequently becomes the primitive respiratory tract.
- Lumen of the dorsal tube fills with ciliated-columnar epithelium

- By week 16 the columnar epithelium lining is replaced by stratified squamous epithelium
Disorders of the Esophagus
Congenital Disorders
Esophageal Atresia and Tracheoesophageal Fistula

- Result from failure of the foregut to divide into trachea and esophagus
- Occur in 1 of every 4500 live births
- Slight male predominance
Esophageal Atresia and Tracheoesophageal Fistula

- Most present as infants
  - Food regurgitation
  - Drooling
  - Aspiration

- Excellent prognosis if diagnosis and surgical correction occur early
Congenital Esophageal Stenosis

- Rare (1 in 25,000 live births)
- The stenotic segment varies from 2 to 20 cm in length
- Usually located within the middle or lower third of the esophagus
- Cause not entirely clear
Congenital Esophageal Stenosis

- Tight stenoses are symptomatic in infancy

- Dysphagia and regurgitation in childhood when more solid food is ingested

- Treatment
  - Dilation
  - Surgical resection of the involved segment
Tubular Esophageal Duplications

- Result of morphogenetic abnormality occurring around 5-8th week of gestation
- Covered by two muscle layers
Esophageal Duplications

- Some run parallel to and communicate with the esophageal lumen

- Symptoms
  - Dysphagia
  - Epigastric pain
  - Retrosternal pain
  - Most present before age of 2
Esophageal Duplications

- **Treatment**
  - Surgical resection for symptomatic patients
  - Some reports of endoscopic treatment
Esophageal Duplication Cysts

- Result of abnormal budding of the primitive tracheobronchial tree
- They can be periesophageal
- More commonly intrapulmonary or in the mediastinum
Esophageal Duplication Cysts

- **Bronchogenic cysts**
  - May contain smooth muscle, hyaline cartilage, or a focus of seromucous glands

- **Enteric**
  - Lined with intestinal epithelium or gastric mucosa

- **Neuroenteric cysts**
  - May have one component in the posterior mediastinum and the other inside the vertebral canal
Esophageal Duplication Cysts

- Some asymptomatic
  - Mediastinal mass on a chest radiograph
  - Submucosal lesion on an EGD

- Symptoms
  - Respiratory symptoms
  - Dysphagia
  - Regurgitation
Esophageal Duplication Cysts

- Imaging
  - EGD: Protruding submucosal mass
  - EUS can confirm the diagnosis
    - No FNA (can cause infection of the cysts or bleeding)
Esophageal Duplications and Cysts

- **Treatment**
  - Surgical resection
  - Reports of endoscopic treatment
Vascular Anomalies

- Intrathoracic vascular anomalies are present in 2% to 3% of the population
- Only rarely do they produce symptoms of esophageal obstruction
Dysphagia Lusoria

- Impingement of aberrant R subclavian artery on proximal esophagus
- Lusoria = trick of nature
Dysphagia Lusoria

- **Symptoms**
  - Most asymptomatic
  - Dysphagia for solids
  - Regurgitation
  - Chest pain
  - Coughing

- In rare cases rupture of an aneurysmal aberrant artery
Dysphagia Lusoria

Diagnosis

- Barium esophagram
  - Pencil-like indentation at the level of the third and fourth thoracic vertebrae
- Confirmation is by CT, MRI, arteriography, or EUS
- Esophageal manometry
  - High-pressure zone at the location of the aberrant artery
Dysphagia Lusoria

- **Treatment**
  - Mild to moderate symptoms
    - Dietary modification
  - Severe cases
    - Surgical intervention should be considered
Distal Esophageal Rings

- Type A ring
- Type B (Schatzki's) ring
Type A Ring

- It is a broad band of hypertrophied muscle that constricts the lumen
- Corresponds to the upper end of the lower esophageal sphincter
- Rare
- Generally asymptomatic
- If symptomatic
  - 50-French mercury-weighted esophageal dilator
  - Botulinum toxin
Type B Ring

- Schatzki's ring
- 4% of endoscopies
- Thin membrane at squamocolumnar junction
- Composed of only mucosa and submucosa
- Congenital or acquired
- Associated with GERD
Type B Ring

- Most asymptomatic
  - No treatment
- Symptomatic
  - Diameter < 13 mm
  - Passage of single (≥50-French) bougie or (18-20mm) balloon dilator
Esophageal Webs

- Common in the cervical esophagus
- Developmental anomalies
  - Thin horizontal membranes of stratified squamous epithelium
- Rarely encircle the lumen
Esophageal Webs

- Best demonstrated on an esophagogram with the lateral view
- When symptomatic they cause dysphagia for solids
- Respond well to esophageal bougienage with mercury-weighted dilators
Plummer-Vinson
Paterson-Kelly Syndrome

- Cervical esophageal webs
- Dysphagia
- Iron deficiency anemia

- Primarily in women
- Reports of association with celiac disease
- Increased risk for squamous carcinoma of the pharynx and esophagus
- Correction of iron deficiency may result in resolution of the associated dysphagia and disappearance of the web
Cervical Inlet Patch

- Heterotopic gastric mucosa of the esophagus
  - Can occur in almost any part of the gastrointestinal tract

- Commonly missed during endoscopy due to difficulty in examining this area.
  - Incidence 0.29 to 10%
Pathophysiology

- Represent esophageal columnar embryologic remnants that had failed to transform to squamous lining

- Microscopically
  - Gastric mucosa containing either cardiac, antral and potentially acid-secreting fundic mucosa
Cervical Inlet Patch

- Symptoms
  - Nonspecific throat and esophageal symptoms such as cricopharyngeal spasm
  - Upper esophageal spasm
  - Odynophagia

- Complications
  - Ulceration
  - Bleeding
  - Perforations
  - Stricture
  - Malignant transformations

- Treatment
  - Acid suppression with proton pump inhibitor
  - Reports of ablation
40 yo male with h/o asthma p/w dysphagia for solids

- Rippling of esophagus which disappears with insufflation
Feline Esophagus

- Not EoE
  - Persist with air insufflation
  - Less tightly spaced
- May represent contraction of muscularis mucosa
An 82 yo man complains of dysphagia for solid food for 3 years. He feels that food gets stuck in his throat. He occasionally experiences a sensation of gurgling in his neck, and sometimes regurgitates undigested food.

Most likely diagnosis is?

a) Squamous cell carcinoma of cervical esophagus
b) Diffuse idiopathic skeletal hyperostosis
c) EoE
d) Zenker’s diverticulum
Most likely diagnosis is?

a) squamous cell carcinoma of cervical esophagus
b) Diffuse idiopathic skeletal hyperostosis
c) EoE
d) Zenker’s diverticulum

Old patient with neck gurgling = Zenker’s
Zenker’s Diverticulum

- A sac formed by the herniation of mucosa and submucosa of the hypopharynx through Killian’s dehiscence

- Killian’s area
  - An area of weakness in posterior wall of hypopharynx just above the cricopharyngeus muscle

- May result from poor distensibility of the UES muscles caused by fibrosis (wear and tear of swallowing over many decades)
Zenker’s Diverticulum

- When pharyngeal contractions attempt to force a swallowed bolus through the compromised lumen → high pressure in the walls of hypopharynx

- Over time, the high pressure forces more of the mucosa to herniate through Killian’s dehiscence and diverticulum enlarges
Zenker’s Diverticulum

- Symptoms
  - Gurgling in the neck
  - Regurgitation of undigested food
  - Halitosis
  - Visible lump on side of the neck
  - Large diverticula can push on the esophagus causing dysphagia
Zenker’s Diverticulum

- Diagnostic Studies
  - EGD
  - Barium Swallow
Treatment

- Surgical or endoscopic
- Diverticulectomy
- Should also have cricopharyngeal myotomy to prevent recurrence
Epiphrenic Diverticulum

- Arise from distal esophagus
- Commonly associated with underlying spastic esophageal motility disorder
- Can increase in size resulting in food retention and regurgitation

Treatment

- Surgical
  - Diverticulectomy
  - Treatment of underlying motility disorder
Esophageal Intramural Peudodiverticulosis

- Benign, multiple tiny flask-shaped out-pouching in esophagus
- Formed by dilation of submucosal esophageal glands
- Rare (200 cases in literature)
Esophageal Intramural Pseudodiverticulosis

- **Etiology**
  - Candidiasis
  - GERD
  - Corrosive-acid injury
  - Esophageal malignancy
Esophageal Intramural Peudodiverticulosis

 Symptoms

 - Intermittent solid food dysphagia

 Diagnostic Studies

 - EGD
 - Barrium Esophagram
Esophageal Intramural Pseudodiverticulosis

- Treatment
  - Dilation
  - Treatment of Candidiasis
  - PPI
Sebaceous Heterotopias

- Sebaceous heterotopias appear as single or multiple yellowish bumps.
- 4% of individuals
- Solitary or multiple
- Found in all age groups
Glycogen Acanthosis

- Multiple, uniformly sized round elevations in otherwise normal-appearing mucosa
- Midportion of the esophagus
- Up 15% of all upper endoscopies
- 2 to 10 mm in diameter
- Men 40-50s
Glycogen Acanthosis

- The pathogenesis unclear
  - No relation to glucose metabolism, diabetes

- Visual findings on endoscopy are highly predictive (biopsy not needed)
Esophagitis Dissecans Superficialis

- Sloughing of the entire length of esophageal mucosal epithelium
- Rare
- Seen in association with:
  - Pemphigus vulgaris 5%
  - Complication of endoscopy with esophageal dilation
  - Ingestion of oral bisphosphonates
  - Celiac disease
  - Incidental ingestion of a fish bone
34 yo male reports difficulty swallowing solids and sense of fullness in his throat. On a recent date he choked on a piece of steak and his girlfriend was frightened to see a fleshy tube snap out of his mouth and than snap back. She ran away in horror and never came back.
Giant Fibrovascular Polyp

- Variety of lesions including fibromas, fibrolipomas, myomas, and lipomas
- Contain a mixture of fibrous, vascular, and adipose tissue covered by squamous epithelium
- Usually located in upper third of the esophagus
- 75% in men
- 50s-60s
- Up to 20 cm
Fibrovascular Polyps

**Symptoms**
- Most asymptomatic
- Case reports of large lesions causing asphyxiation
- Dysphagia

**Treatment:**
- Snare polypectomy
- EUS should be performed before excision to rule out the presence of a large vessel feeding the stalk
- Surgical resection if large feeding vessel is present or technically unable to
Pill esophagitis often involves the esophagus at the level of the aortic arch. This is because the aortic arch narrows the lumen of the esophagus and because:

a) This is the area where the amplitude of peristaltic wave is the lowest.
b) This is the area where the density of inhibitory neurons is the highest.
c) This is the area where number of submucosal glands is normally the highest.
d) This is the area where infiltration with eosinophils is the highest.
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