BENIGN ESOPHAGEAL DISEASES

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Introduction
Outline

- Esophageal Anatomy
- Clinical Presentation of Benign Esophageal Diseases
- Structural Lesions of the Esophagus
- Esophagitis
- Gastroesophageal Reflux Disease (GERD)
- Motility Disorders of the Esophagus
- Esophageal Symptoms in Patients After Bariatric Surgery
ESOPHAGEAL ANATOMY
Esophagus

- Muscular tube whose primary function is to deliver swallowed material from the mouth to the stomach
- 25cm in length
  - Measured from its origin in the neck just below the cricoid cartilage
Muscles of Esophagus

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

- **Inner layer of circular muscle**
  - Responsible for squeezing motion that affects peristalsis and closure of esophageal sphincters
Upper Esophageal Sphincter (UES)

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

- The esophagus passes from the chest into the abdomen through the diaphragmatic hiatus
- Approximately 2cm of the distal esophagus normally lies within the abdomen
Lower Esophageal Sphincter (LES)

- 3cm in length
- External
  - Skeletal muscle of the crural diaphragm
- Internal
  - Smooth muscle of the distal esophagus
Z Line

- Junction between the esophageal squamous epithelium and gastric-type columnar epithelium
- 1cm below the sphincter’s proximal border
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
- 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
- Proximal esophagus is subject to diseases that affect striated muscle and its CNS innervation
  - Polymyositis
  - Myasthenia gravis
- Distal esophagus is susceptible to diseases of smooth muscle and enteric neurons
  - Scleroderma
  - Achalasia
Symptoms of Benign Esophageal Diseases

- Dysphagia
  - Oropharyngeal
  - Esophageal
- Heartburn
- Chest pain
- Belching
- Extra-esophageal symptoms (primarily associated with GERD, often presenting to ENT/Pulm physicians)
  - Globus
  - Halitosis
  - Laryngopharyngeal reflux (LPR)
  - Asthma
  - Cough
  - Sore Throat
  - Hoarseness
Evaluation Of Benign Esophageal Diseases

- Barium esophagram
  - Cervical and thoracic with barium tablet (13mm)
  - Symptomatic usually with lumen less than 13 mm
- EGD
- Modified barium swallow (MBS)
- Esophageal manometry
- pH studies
Diagnostic Studies

- Useful for evaluating esophageal disease
- Barium esophagram
  - With cervical and thoracic views
  - With 13.5mm barium table
- Modified Barium Swallow (MBS)
  - Done with speech therapy and radiology
  - Most useful for evaluation of oropharyngeal dysphagia
- EGD/biopsies
- Esophageal manometry
  - High Resolution Esophageal Manometry (HREM)
- Multi-channel Intraluminal Impedance (MII)
  - MII EM
  - MII pH
- Laryngoscopy
- pH studies
  - 24 hour pH
  - BRAVO
Evaluation of Esophageal Dysphagia

Esophageal dysphagia

History of prior radiation, caustic injury, surgery for laryngeal or esophageal cancer, complex stricture

- Yes
  - Barium swallow
  - Structural abnormality
    - Ring
    - Web
    - Stricture
    - Diverticulum
    - Erosive esophagitis
    - Tumor (benign/malignant)
    - Infectious esophagitis
    - Eosinophilic esophagitis

- No
  - Upper endoscopy +/- esophageal biopsies
  - Normal
  - Dysphagia to solids alone
    - Barium swallow (if not previously performed)
    - Normal
    - Structural abnormality missed on upper endoscopy (e.g., web, extrinsic compression)
    - Secondary esophageal motility disorder (e.g., systemic sclerosis, diabetes)
    - Primary esophageal motility disorder
    - Equivocal results

  - Dysphagia to solids and liquids and/or a suspected motility disorder
    - Esophageal manometry
    - Normal
    - Barium swallow if not previously performed
    - Consider evaluation for functional dysphagia by ruling out GERD
## Causes Of Oropharyngeal Dysphagia

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<td><strong>myopathic</strong></td>
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<td>Connective tissue disease (overlap syndrome)</td>
<td>Zenker’s diverticulum</td>
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<td>Dermatomyositis</td>
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<td>Myasthenia gravis</td>
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<td>Myotonic dystrophy</td>
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<td>Oculopharyngeal dystrophy</td>
<td>Congenital (cleft palate, diverticula, pouches, etc)</td>
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<td>Polymyositis</td>
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Evaluation/Management Of Oropharyngeal Dysphagia
Evaluation Of Unexplained Chest Pain

Excluding coronary artery disease
Reassure patient not cardiac, not life threatening

EGD
Ambulatory esophageal and gastric impedance-pH monitoring on therapy* -

Normal
Manometry and provocative tests
- Normal
Consider nonesophageal etiology or psychologic evaluation or trial of imipramine or trazodone
- DES, nutcracker esophagus, hypertensive LES
Calcium blocker or nitrates

Abnormal (acid or nonacid reflux)
Treatment for GERD
- Good response
GERD maintenance therapy

Proton pump inhibitor, BID x 8 weeks
Poor response
STRUCTURAL LESIONS OF THE ESOPHAGUS
Structural Lesions

- Associated with anatomic narrowing
- Usually presenting with dysphagia
- When luminal diameter <13 mm
- Hernias
  - Hiatal
  - Paraesophageal
- Rings
- Webs
- Food impaction
- Foreign bodies
- Diverticulum
Hiatal Hernias

- **Sliding hiatal hernia**
  - Displacement of the internal LES from the crural diaphragm into the chest
- **Paraesophageal hiatal hernia**
  - Part of the stomach protrudes into the chest next to the esophagus
Vascular Anomalies

- Vascular anomalies
  - Intrathoracic vascular anomalies are present in 2-3% of the population
  - Only rarely do they produce symptoms of esophageal obstruction
  - Dysphagia Lusoria ("trick of nature")
    - Impingement of aberrant right subclavian artery on proximal esophagus

Dysphagia Lusoria
Distal Esophageal Rings

- Type A ring
- Type B ring
  - Known as Schatzki ring or Kramer-Inglefinger ring
Type A Ring

- Broad band of hypertrophied muscle that constricts the lumen
- Corresponds to the upper end of the LES
- Rare
- Generally asymptomatic
- Treatment if symptomatic
  - 50-French mercury-weighted esophageal dilator
  - Botox
Type B Ring

- Schatzki’s ring
- 4% of endoscopies
- Thin membrane at squamocolumnar junction
- Composed of only mucosa and submucosa
- Congenital or acquired
- Most asymptomatic, but can be associated with GERD
- Symptomatic
  - Diameter <13mm
  - 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
- Best demonstrated on an esophagogram with the lateral view
- Cause dysphagia for solids when symptomatic
- Respond well to esophageal bougienage with mercury-weighted dilators
Esophageal Dilation

Maloney or Savary (guidewire) Dilation

A

Dilation

Esophageal stricture

B

1

...inserted, expanding stricture

C

Larger dilators may be inserted

Balloons Dilation
Plummer-Vinson (Paterson-Kelly) Syndrome

- Characterized by:
  - Cervical esophageal webs
  - Dysphagia
  - Iron deficiency anemia
- Primarily in women
- Associated with celiac disease
- Increased risk for squamous carcinoma of the pharynx and esophagus
- Correction of iron deficiency may result in resolution of the dysphagia and disappearance of the web
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)
- Over time, high pressure forces more of the mucosa to herniate through Killian’s dehiscence and diverticulum enlarges
- 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
  - Barrium swallow

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

- Arises 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
Case

- 34 yo male reports difficulty swallowing solids and a sense of fullness in his throat
- On a recent date, he chocked on a piece of steak and his girlfriend was frightened to see a fleshy tube snap out of his mouth and then snap back
- She ran away in horror and never came back
Case
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
- Age 50s-60s
- Up to 20cm
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 remove endoscopically
Case: Food Impaction

- 24 yo male with 4-5 years of solid food dysphagia, seasonal allergies, and asthma, presents with food impaction

- Endoscopic devices for removing food impaction
  - Snares
  - Forceps
  - Nets
  - Graspers
  - Baskets
Timing Of Endoscopy For Ingested Foreign Bodies

Emergent endoscopy
- Patients with esophageal obstruction (i.e., unable to manage secretions)
- Disk batteries in the esophagus
- Sharp-pointed objects in the esophagus

Urgent endoscopy **(within 24 hours)**
- Esophageal foreign objects that are not sharp-pointed
- Esophageal food impaction in patients without complete obstruction
- Sharp-pointed objects in the stomach or duodenum
- Objects >6 cm in length at or above the proximal duodenum
- Magnets within endoscopic reach

Nonurgent endoscopy
- Coins in the esophagus may be observed for 12-24 hours before endoscopic removal in an asymptomatic patient
- Objects in the stomach with diameter >2.5 cm
- Disk batteries and cylindrical batteries that are in the stomach of patients without signs of GI injury may be observed for as long as 48 hours. Batteries remaining in the stomach longer than 48 hours should be removed.
Decisions Regarding Foreign Body Management

- Airway protection
  - Intubation may be required for upper esophageal obstructions
- Overtube
- Endoscopic hood for sharp objects
- Radiologic localization prior to extraction
- Thoracic surgery or ENT referral for foreign bodies not amenable to endoscopic removal
ESOPHAGITIS
CAUSES OF ESOPHAGITIS

- GERD
- Pills/medication related
- Caustic ingestion
  - Acids
  - Alkalis
  - Causing severe esophagitis with long strictures
- Radiation
  - Usually mediastinal
- Infections
  - CMV
  - Herpes simplex
  - HIV
  - Candida/fungal
  - Graft vs. host disease – BMT patients
- Eosinophilic esophagitis (EoE)
- Pemphigus
Pill Esophagitis

- Pill esophagitis often involves the esophagus at the level of the aortic arch because:
  - This is the area where the amplitude of the peristaltic wave is the lowest
  - This is the area where the density of inhibitory neurons is the highest
  - This is the area where the number of submucosal glands is normally the highest
  - This is the area where infiltration with eosinophils is the highest

- Often involves these medications
  - Antibiotics (e.g., tetracycline, doxycycline, clindamycin)
  - Ant-inflammatories (e.g., aspirin, NSAIDs esp ibuprofen – avoid HS use)
  - Bisphosphonates (e.g., alendronate)
  - Other (e.g., potassium chloride, quinidine, iron)
Eosinophilic Esophagitis (EoE)

- Defined by a panel of experts as “a chronic immune/antigen-mediated esophageal disease characterized clinically by symptoms related to esophageal dysfunction and histologically by eosinophil-predominant inflammation”
  - Estimated incidence 9.45/100,000
  - Estimated prevalence 55/100,000
- Should be considered in adults with a history of food impaction, persistent dysphagia, or GERD that fails to respond to medical management
- Clinical manifestations
  - Dysphagia
  - Food impaction
  - Chest pain
  - Refractory heartburn or other reflux symptoms
- Diagnosis made primarily by endoscopy and biopsy
  - Biopsies from mid/proximal and distal esophagus
  - Histology – need to differentiate from eosinophilia associated with GERD
  - Usually >15 eos per HPF
- Endoscopic features
  - Stacked circular rings
  - Strictures
  - Linear furrows
  - Small caliber esophagus
Eosinophilic Esophagitis Treatment

- Dietary therapy
  - Elimination diets
  - Allergy/immunology evaluation

- Pharmacologic
  - Topical steroids
    - Swallowed corticosteroids (fluticasone spray swallowed – adults 440-880mcg BID for 2 months)
  - Systemic steroids (if failed topical steroids)
  - PPIs (for 2 months)

- Endoscopic
  - Narrow caliber esophagus requires more careful dilatation over a guide wire
  - Perforation rate 3/1000, similar to non-EoE strictures
High Resolution Manometry In EoE

- 32% of EoE patients demonstrated pan-esophageal pressurization events with higher volume bolus challenge
- Esophageal pressurization may reflect reduced distensibility/compliance of the esophagus in EoE
GASTROESOPHAGEAL REFUX DISEASE (GERD)
GERD

- Anatomy/physiology
- Clinical manifestations and presentation
  - Esophageal symptoms
  - Extra-esophageal symptoms
- Diagnosis
  - Barium esophagram
  - EGD
  - pH studies (24 hour vs. BRAVO)
  - Esophageal motility
- Complications
  - Non-erosive reflux disease (NERD)
  - Acid vs. bile reflux
- Treatment
  - Medications
    - Medication side effects and complications
  - The refractory patient
    - Medical treatment (including baclofen)
    - Surgical
    - Endoscopic
GERD Introduction

- Montreal Classification defines GERD as a condition that develops when reflux of stomach contents causes troublesome symptoms or complications.
- Montreal Working Group defined heartburn as troublesome if symptoms occur 2 or more days per week or moderate to severe symptoms occur more than one day a week (usually this is for >6 months).
- GERD prevalence of 10-20% in the Western world.
- Over $1B annually OTC remedies, $10B PPIs.
Pathophysiology Of GERD

- Primary event is movement of gastric juice from stomach into esophagus
- 1) GE junction incompetence
  - Transient LES relaxations (tLESRs) – major factor in mechanism of belching as well
    - tLESRs more frequent and for prolonged periods
    - Associated with acid reflux as opposed to gas venting
    - Can be inhibited by GABA type B agonists (baclofen)
  - Vagally mediated reflex
  - Hypotensive LES
    - Minority of patients
  - Anatomic disruption of GEJ (hiatal hernia)
  - Obesity
  - Pregnancy – 30-50% with reflux
    - Mechanical and hormonal
Pathophysiology Of GERD

- Factors which reduce LES pressure
  - Gastric distension
  - CCK
  - Foods (fat, chocolate, alcohol, caffeine)
  - Smoking
  - Drugs (e.g., nitrates, CCBs, narcotics, benzos, progesterone)

- 2) Esophageal acid clearance
  - Prolonged with esophagitis and can be prolonged with hiatal hernia

- 3) Esophageal emptying
  - Peristaltic dysfunction
  - Intra-esophageal reflux

- 4) Salivation
  - If reduced, can contribute to GERD

- 5) Esophageal sensitivity
  - Non-erosive reflux disease (NERD)
- GEJ forms anti-reflux barrier
- Dependent on:
  - GEJ complex
  - Changes with gastric distension
  - Esophageal motility
  - Intra-abdominal pressure
  - Gravity
Diagnosis Of GERD

- Presumptive diagnosis with typical symptoms of heartburn and regurgitation
  - Can treat empirically with a PPI
  - Belching as a primary symptom often not GERD related
- Patients with non-cardiac chest pain suspected due to GERD should have cardiac cause excluded before GI evaluation
- These studies/procedures NOT required to diagnose GERD in the presence of typical GERD symptoms:
  - Barium radiographs
  - Upper endoscopy
  - Biopsies from distal esophagus
  - Esophageal manometry
  - Ambulatory reflux monitoring
  - Screening for H. pylori infection
- Endoscopy recommended for patients with alarm symptoms and for screening patients at high risk for complications
  - For patient who are acid suppressant dependent
  - Especially men over age 50
  - Repeat endoscopy not indicated for patients without Barrett’s esophagus in absence of new symptoms
Extraesophageal Manifestations Of GERD

- GERD can be considered a potential co-factor in patients with:
  - Asthma
  - Chronic cough
  - Laryngitis
- PPI trial is recommended to treat extraesophageal symptoms in patients who also have typical GERD symptoms
### Summary of Diagnostic Testing Evidence

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<th>Indication</th>
<th>Highest Level of Evidence</th>
<th>Recommendation</th>
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<tr>
<td>PPI trial</td>
<td>Classic symptoms, no warning signs,</td>
<td>Meta-analysis</td>
<td>Negative trial does not rule out GERD</td>
</tr>
<tr>
<td>Barium swallow</td>
<td>Not for GERD diagnosis, Use for evaluation of dysphagia</td>
<td>Case-control</td>
<td>Do not use unless evaluating for complication (stricture, ring)</td>
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<tr>
<td>Endoscopy</td>
<td>Alarm symptoms, screening of high-risk patients, chest pain</td>
<td>Randomized Controlled Trial</td>
<td>Consider early for elderly, those at risk for Barrett’s, non-cardiac chest pain, patients unresponsive to PPI</td>
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<tr>
<td>Esophageal biopsy</td>
<td>Exclude non-GERD causes for symptoms</td>
<td>Case-Control</td>
<td>Not indicated for diagnosis of GERD</td>
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<tr>
<td>Esophageal manometry</td>
<td>Preoperative evaluation for surgery</td>
<td>Observational</td>
<td>Not recommended for GERD diagnosis. Rule out achalasia scleroderma-like esophagus preop</td>
</tr>
<tr>
<td>Ambulatory reflux</td>
<td>Preoperatively for non-erosive disease, refractory GERD symptoms, GERD diagnosis in question</td>
<td>Observational</td>
<td>Correlate symptoms with reflux, document abnormal acid exposure or reflux frequency</td>
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Continuous pH Monitoring

- Acid-sensitive catheter is placed in the esophagus and is attached to a small monitoring device.
- Changes in esophageal pH are recorded over an extended period of time (up to 24 hours).
- Provides information on the severity and pattern of reflux.
- Considered the best test for the diagnosis of GERD, however there is a 10-20% false negative rate.
- If intra-esophageal pH is < 4 for more than 10% of the time, patient is considered to have pathologic reflux.
Multichannel Intraluminal Impedance (MII) Testing

- MII is a catheter-based method to detect intraluminal bolus movement within the esophagus
- The principal of impedance testing is based on a measurement of changes in resistance to electrical current when a bolus passes by a pair of metallic rings mounted on a catheter
- Liquid-containing boluses with an increased number of ions and higher conductivity will lower the impedance to a nadir value
- Impedance returns to baseline once bolus is cleared by a contraction
- Can be performed in combination with manometry or pH testing
- When combined with manometry, bolus transit data can add a functional analysis to manometrically recorded contractions
- When combined with pH testing, it allows for the detection of GE reflux independent of pH (i.e., both acid and non-acid reflux)
Indications For MII-EM

- Similar to those for esophageal manometry
  - Evaluation of patients with dysphagia, non-cardiac chest pain, or heartburn regurgitation
  - Pre-op evaluation prior to anti-reflux procedures (surgical or endoscopic)
  - Location of the LES prior to pH catheter placement
- MII-pH can be performed on or off PPI therapy, but for diagnostic purposes in the refractory patient, stopping acid suppression therapy for 1-2 weeks may add additional diagnostic value
Physiology Of Gastric Acid Secretion

- Normal stomach pH
  - Basal: pH 1-2
  - Post prandial (1 hour): pH 4-5

- Parietal cell
  - Primary acid producing cell
  - Located in body and fundus of stomach
  - H+/K+ ATPase pump
    - Generates largest ion gradient known in vertebrates
  - Influenced by acetylcholine, histamine, gastrin, prostaglandins
# Pharmacologic Management Of GERD

- **Antacids**: local neutralization of acid
  - Aluminum hydroxides
  - Magnesium hydroxides
  - Calcium carbonate
  - Sodium bicarbonate
  - Gaviscon (aluminum hydroxide + magnesium carbonate)

- **H2 receptor antagonists (H2RAs)**: compete with histamine for binding to H2 receptors on parietal cells
  - Cimetidine
  - Ranitidine
  - Famotidine
  - Nizatidine

- **Proton pump inhibitors (PPIs)**: prodrugs that require activation by an acidic environment (symptom improvement occurs with pH<4)
  - Half-life 1-2 hours
  - Full effect may take up to 2-5 days
  - Duration of effect 24-48 hours, but can affect acid secretion for up to 7-14 days
  - Some patients with defective proton pumps may respond better to H2RAs
    - Omeprazole
    - Lansoprazole
    - Rabeprazole
    - Pantoprazole
    - Esomeprazole

- **Cytoprotectants**
  - Sucralfate
  - Misoprostol
  - Bismuth compounds
Management Of GERD

- **Lifestyle**
  - Weight loss for overweight patients or those with recent weight gain
  - Head of bed elevation and avoidance of meals 2-3 hours before bedtime
  - Routine global elimination of food that can trigger reflux is not recommended

- **Medication**
  - An 8-week course of PPIs is the therapy of choice for symptom relief and healing of erosive esophagitis
  - PPI therapy should be initiated at once a day dosing before the first meal of the day
  - Twice daily dosing, a different PPI, and/or adjustment of dose timing should be considered for patients with a partial response to initial PPI therapy
  - Maintenance PPI therapy should be administered for patients who continue to have symptoms after PPI is discontinued and in patients with complications including erosive esophagitis and Barrett’s esophagus
    - For long-term PPI therapy, lowest effective dose and on-demand/intermittent therapy should be used if possible
  - H2-receptor antagonist (H2RA) therapy can be used as a maintenance option in patients without erosive disease if patients experience heartburn relief
  - Bedtime H2RA therapy can be added to daytime PPI therapy in selected patients with night-time reflux
  - Therapy for GERD other than acid suppression should not be used in GERD patients without diagnostic evaluation
  - H2RAs safe in pregnant patients if clinically indicated; PPIs only if benefit outweighs risk
Potential Risks Associated With PPIs

- Osteoporosis – especially in post-menopausal women; need for calcium and vitamin D supplementation in patients on long-term therapy
- PPI therapy can be a risk factor for Clostridium difficile infection and should be used with care in patients at risk
- Short-term PPI use may increase the risk of community-acquired pneumonia
  - Risk does not appear elevated in long-term users
- Potential for malabsorption
  - Magnesium
  - Calcium
  - Vitamin B12
  - Iron
- Atrophic gastritis in over 30% of patients with chronic use
  - Theoretical increased risk of gastric cancer
- Gastric polyps
- Associated with kidney disease
  - Acute interstitial nephritis
  - Chronic kidney disease
- Associated with dementia
- PPI therapy does not need to be altered in concomitant clopidogrel users
Management of GERD Refractory To PPI Therapy

- Optimize PPI therapy
- Perform upper endoscopy to exclude non-GERD etiologies
- For patients with persistent extraesophageal symptoms, assessment for other etiologies through concomitant evaluation by ENT, pulmonary, or allergy specialists
- For patients with negative evaluation, would perform ambulatory reflux monitoring
  - Reflux monitoring off medication can be performed by any available modality
  - Testing on medication should be performed with impedance-pH monitoring to enable measurement of nonacid reflux
- Refractory patients with objective evidence of ongoing reflux as cause of symptoms should be considered for additional antireflux therapies that may include surgery or transient lower esophageal sphincter relaxation (TLESR) inhibitors (e.g., baclofen)
GERD Complications

- **Esophagitis**
  - Presence of inflammatory cells within the esophageal mucosa
  - Ranges from microscopic changes in biopsies (microscopic esophagitis) to inflamed mucosa without erosion (nonerosive esophagitis) to frankly eroded or ulcerated mucosa (erosive esophagitis)
  - Severity of esophagitis not well correlated with severity of GERD symptoms
  - LA Classification (Grade A-D)
- **Barrett’s esophagus**
  - Length of distal esophagus is covered by an abnormal-looking cellular lining
  - Consequence of abnormal healing of erosive esophagitis
  - Associated with an increased risk of developing esophageal cancer
- **Esophageal stricture**
  - Narrowing of the esophagus due to the healing process of ulcerative esophagitis
  - May result in solid food dysphagia and episodic food impaction
Surgical Therapy Of GERD

- A number of surgical approaches have been advocated
- All involve an attempt to bolster the strength of the antireflux barrier
- The most commonly employed surgical approach is referred to as a Nissen fundoplication
Endoscopic And Minimally Invasive GERD Therapy

- Still considered experimental
  - Suturing devices (e.g., EndoCinch)
  - Radiofrequency ablation (e.g., Stretta)
  - Implants/injections (e.g., LINX)
  - Neurostimulation (e.g., EndoStim)
Extraesophageal Manifestations of GERD - Cough

- Cough
  - GERD is often reported to be the 2nd or 3rd most common cause of persistent cough (and most common in some reports)
  - Heartburn or sour taste in mouth absent in more than 40% of patients in whom cough is due to reflux
  - Several factors potentially responsible for cough due to GERD
    - Stimulation of receptors in the upper respiratory tract
    - Aspiration of gastric contents (acid, pepsin), leading to stimulation of receptors in the lower respiratory tract
    - Esophageal-tracheobronchial cough reflex induced by acid reflux into the distal esophagus
  - GERD can also contribute to asthma symptoms
Laryngopharyngeal Reflux (LPR)

- Retrograde movement of gastric contents into the laryngopharynx leading to symptoms referable to larynx/hypopharynx
- Symptoms include dysphonia/hoarseness, globus, mild dysphagia, chronic cough, nonproductive throat clearing
- Primarily an UES problem that mainly occurs in upright position during periods of physical exertion (e.g., bending over, Valsava, exercise)
- Distinct clinical entity from GERD (GERD mainly a problem of the LES)
- Much less acid exposure is necessary to create LPR compared to GERD
- Most patients relatively unaware of LPR, with only 35% reporting heartburn
LPR Treatment

- Drug therapy
  - Acid suppression
    - PPIs
    - H2 Blockers
    - Antacids
  - Neuromodulating agents
    - Tricyclic antidepressants
      - Nortriptyline
    - Gabapentin
    - Pregabalin
Extraesophageal Manifestations of GERD - Globus

- **Globus sensation**
  - Functional esophageal disorder characterized by a sensation of a lump or foreign body in the throat
  - Also referred to as globus pharyngeus or globus hystericus
  - Unclear pathogenesis, but etiologies include:
    - Visceral hypersensitivity
    - Abnormalities of the UES
    - Psychologic and psychiatric disorders
    - GERD
Treatment Of Globus

- Conservative therapy
  - Reassurance that globus is a benign disorder

- Acid suppression
  - 6-8 weeks of PPI therapy
  - 1/3 of patients experience partial relief

- Antidepressants (e.g., amitriptyline)

- Other
  - Gabapentin
  - Relaxation therapy
Additional Evaluation Of Globus

- Additional evaluation warranted in patients with recurrent or persistent symptoms despite conservative management or those with alarm features (e.g., pain, lateralization of symptoms, dysphagia, odynophagia, weight loss, change in voice, neck mass, unexplained cervical adenopathy)

- Modalities include:
  - Nasoendoscopy
  - Videofluoroscopy
  - Barium swallow with solid bolus (e.g., barium tablet)
  - Esophageal manometry
  - Esophageal pH and impedance
  - Upper endoscopy
MOTILITY DISORDERS OF THE ESOPHAGUS
Introduction
Motility Disorders

- Presentation
  - Dysphagia
  - Reflux
  - Cough
  - Choking
- Oropharyngeal dysphagia
- Causes
  - Neurologic and neuromuscular disorders
  - Cricopharyngeal dysfunction
  - Disorders that affect the esophageal body
Major Disorders Of Esophageal Peristalsis

- Achalasia
- Hypertensive LES/EGJ outflow obstruction
- Hypertensive peristaltic disorders
  - Nutcracker esophagus
  - Jackhammer esophagus ("spastic nutcracker")
- Distal esophageal spasm (DES)
- Ineffective esophageal motility (IEM)
- Non-specific motor disorders (e.g., secondary to diabetes)
Achalasia

- Most common esophageal motor disorder
  - Incidence 1.6 cases/100,000
  - Prevalence 10 cases/100,000
- Results from inflammation and degeneration of neurons (myenteric plexus in esophageal wall) – possible viral etiology
- Loss of inhibitory neurons in esophagus results in increased LESP (not required) and more importantly inability of LES to relax to baseline
- Aperistalsis
- Dysphagia mainly result of defect in LES relaxation
Hypertensive LES

- **Presentation**
  - Chest pain/dysphagia/globus
  - May be an achalasia variant

- **Diagnosis**
  - LES pressure >35mmHg and failure to relax below IRP of 15mmHg
  - Normal peristalsis
  - More important than pressures: failure of full relaxation of LES (incomplete bolus transfer)
  - Can overlap with other spastic esophageal conditions
    - May need additional provocation (bread swallows, multiple rapid swallows, solid swallows)
    - EUS recommended prior to therapy to exclude infiltrative or compressive disease (e.g., malignancy)

- **Treatment**
  - Balloon dilation or Botox injection
  - POEM
Jackhammer Esophagus

- Also known as hypercontractile esophagus or spastic nutcracker esophagus
- Offshoot of nutcracker esophagus
  - 4% of manometry referrals; rule out mechanical obstruction
- Presentation
  - Chest pain/dysphagia
- Diagnosis
  - At least one DCI > 8000
  - Repeated high amplitude contractions
  - Normal DL (≥ 4.5 sec)
- Treatment
  - Trial of nitrates (SL or oral) + PPI
  - Calcium channel blockers (diltiazem) PRN
  - Sildenafil PRN
  - Tricyclic antidepressants
Distal Esophageal Spasm (DES)

- Unknown etiology; likely related to defects in inhibitory neural pathways of esophagus
  - Rarest manometric diagnosis (3%)
  - Classic corkscrew esophagus very rare

- Presentation
  - Chest pain/dysphagia
  - Symptom correlation poor

- Diagnosis
  - Normal median IRP (LES relaxation), ≥ 20% premature contractions with DCl > 450mmHg x s x cm
  - Some normal peristalsis may be present

- Treatment
  - PPI + Botox injection
  - Surgical myotomy (when all else fails)
Esophageal Manometry - Indications

- Esophageal dysphagia
- Non-cardiac chest pain
- Prior to anti-reflux surgery and consider before esophageal surgery where dysphagia could result if impaired esophageal function (e.g., hiatal hernia repair)
- For certain diseases of smooth muscle or autonomic nervous system
  - Scleroderma
  - Intestinal pseudo-obstruction
The Chicago Classification

- Practical classification for esophageal motility disorders based on HRM
- Focus on disorders of the LES relaxation as a fundamental problem
- Concept to prioritize identified dysfunction into 3 subgroups
  - Achalasia/EGJ dysfunction
  - Motility patterns never seen in normal people
  - Peristaltic abnormalities out of range of normal values (>5th or >95th percentile)
The Chicago Classification

1. IRP ≥ ULN and 100% failed peristalsis or spasm
   - Yes: Achalasia
     - Type I: No contractility
     - Type II: ≥20% PEP
     - Type III: >20% spasm (DL<4.5s)
   - No: Disorders with EGJ outflow obstruction

2. IRP ≥ ULN and not Type I-III achalasia
   - Yes: EGJ outflow obstruction
     - Incompletely expressed achalasia
     - Mechanical obstruction
   - No: Major disorders of peristalsis
     - Entities not seen in normal subjects

3. IRP normal and Short DL or high DCI or 100% failed peristalsis
   - Yes: DES
     - ≥ 20% premature (DL<4.5s)
     - Jackhammer esophagus
       - ≥ 20% DCI >8,000 mmHg•s•cm
     - Absent contractility
       - No scorable contraction
       - Consider achalasia
   - No: Minor disorders of peristalsis
     - Impaired clearance

4. IRP normal and ≥50% ineffective swallows
   - Yes: Ineffective motility (IEM)
     - ≥50% ineffective swallows
     - Fragmented peristalsis
       - ≥50% fragmented swallows and not ineffective
   - No: Normal

5. IRP normal and > 50% effective swallows
   - Yes: Normal

Esophageal Manometry

Normal Function

High Resolution Manometry

- Upper esophageal sphincter
- Lower esophageal sphincter
- Esophageal peristalsis
- LES deglutitive relaxation

Distance from mares

Pressure (mmHg)

WS

LES

15 s

25 cm

30 cm

35 cm

40 cm

43 cm

45 cm

20 seconds

0 Pharynx

5 Cm

10

15

20

25

30

35 Stomach
High Resolution Manometry

- Metrics
  - Integrated relaxation pressure (IRP)
    - Assesses adequacy of EGJ relaxation
  - Distal latency (DL)
    - Measure of peristaltic timing
    - Defines interval between UES relaxation and contractile deceleration point (CDP)
  - Distal contractile integral (DCI)
    - Summary measure of the vigor of distal esophageal contractions—contractile amplitude, length, and duration
Manometry Catheter Evolution (1960-2010)
Pressure Topography Of Esophageal Motility

- Pressure magnitude converted into a color scale
  - Cold colors indicate low pressures
  - Hot colors indicate higher pressures
- Defines important anatomical landmarks and abnormalities
- Refines measurement of important motor events
  - EGJ relaxation
  - Peristaltic timing velocity
  - Contractile activity/force/amplitude
- Defines intra-luminal pressurization patterns
- Permits pattern recognition
Normal Esophageal Function

**Conventional Analysis**
- Complete bolus transit
- Peristaltic contractions with pressure amplitude of at least 30mmHg
- Normal LES pressure
- Complete LES relaxation (< 8mmHg)

**Chicago Classification**
- Complete bolus transit
- Peristaltic contractions with a contiguous 20mmHg isobaric contour, no large or small breaks
- Normal LES resting pressure
- IRP < 15mmHg
Achalasia Subtypes

- **Type I**
  - IRP > 15 mmHg
  - Absent peristalsis
  - Absent contractile activity

- **Type II**
  - IRP > 15 mmHg
  - Absent peristalsis
  - >20% swallows with pan-oesophageal pressurization

- **Type III**
  - IRP > 15 mmHg
  - Absent peristalsis
  - 2 or more esophageal contractions with or without periods of compartmentalized pressurization
Achalasia Type I

- Incomplete Bolus Transit
- Absent Peristalsis (Req’d)
  - Low Esophageal Amplitude
  - May have High LES Pressure and/or Incomplete Relaxation

**Conventional Analysis**
- Incomplete bolus transit
- Aperistaltic
- Low esophageal amplitude
- Incomplete LES relaxation
- Typically high LES pressure

**Chicago Classification**
- 100% failed peristalsis
- Incomplete LES relaxation
Achalasia Type II

- Conventional Analysis
  - Incomplete bolus transit
  - Aperistaltic
  - Panesophageal pressurization
  - Incomplete LES relaxation
  - Typically high LES pressure

- Chicago Classification
  - No normal peristalsis
  - Panesophageal pressurization with ≥ 20% of swallows
  - Incomplete LES relaxation

Incomplete Bolus Transit

Absent Peristalsis (Required), Panesophageal Pressurization

May have High LES Pressure and/or Incomplete Relaxation
Achalasia Type III

**Conventional Analysis**
- Incomplete bolus transit
- Aperistaltic
- Esophageal amplitude > 50mmHg
- Incomplete LES relaxation
- Typically high LES pressure

**Chicago Classification**
- No normal peristalsis
- Preserved fragments of distal peristalsis or premature (spastic) contraction with ≥ 20% of swallows
- Incomplete LES relaxation

Incomplete Bolus Transit

Absent Peristalsis (Required), Increased Esophageal Amplitude

May have High LES Pressure and/or Incomplete Relaxation
Hypertensive Disorders: Nutcracker, Jackhammer

**Complete Bolus Transit**
- Complete bolus transit
- Normal peristalsis
- High esophageal amplitude
  (may have prolonged duration)
- Average DEA ≥ 220 mmHg

**Conventional Analysis**
- Normal or high LES pressure
- Complete or incomplete LES relaxation

**Chicago Classification**

**Nutcracker**
- Mean DCI > 5,000 mmHg·s·cm, but not meeting criteria for Jackhammer esophagus

**Jackhammer**
- At least one swallow with a DCI > 8,000 mmHg·s·cm with single peaked or multipeaked contraction
Weak/Ineffective Esophageal Motility (IEM)

- **Incomplete Bolus Transit**
- **Low or Nontransmitted Esophageal Body Contractions**
- **Complete LES Relaxation**

**Conventional Analysis**
- Complete or incomplete bolus transit
- Peristaltic or simultaneous contractions
- Low or nontransmitted esophageal contractions (30mmHg), with 5 or more swallows
- Normal or low LES pressure
- Complete LES relaxation

**Chicago Classification**
- 5 or more swallows with any combination of failed peristalsis or weak contraction with large or small break or with a DCI < 450mmHg·s·cm⁻²
  - Small Peristaltic Breaks 2 - 5cm in length
  - Large Peristaltic Breaks > 5cm in length
- Complete LES relaxation
Distal Esophageal Spasm (DES)

**Conventional Analysis**
- ≥ 20% premature, repetitive (> 2 peaks) contractions
- Complete or incomplete bolus transit
- Prolonged duration (> 6 secs)
- Intermittent normal peristalsis
- High amplitude not common

**Chicago Classification**
- ≥ 20% premature contractions
- Normal IRP
Scleroderma

Conventional Analysis
- Incomplete bolus transit
- Weak to absent lower esophageal contraction (smooth muscle)
- Normal upper esophageal amplitude (striated muscle)
- Low to absent LES pressure (< 10 mmHg)

Chicago Classification
- Not described in the literature on Chicago Classifications
**Impedance Manometry**

- Addition of impedance feature allows information regarding bolus transit to be obtained
- Can identify reflux after a swallow
- Good correlation with timed barium esophagram
  - Tested in 20 achalasia patients
  - 200 ml of barium (barium esophagram) vs 200 ml of saline (impedance manometry) timed at 1 & 5 minutes

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Cho Y. 2014: Am Jo of Gastro
Management Of Achalasia

- Smooth muscle relaxants
- Botulinum toxin
- Pneumatic dilation
- Per oral endoscopic myotomy (POEM)
- Esophageal stent
- Percutaneous gastrostomy tube
- Heller myotomy

PD = pneumatic dilation
Pneumatic dilation protocol
- Rigiflex balloon
- 3cm at 5 psi x 1 min followed by 8 psi x 1 min
- 1-3 weeks later 3.5cm
- 4 weeks later, 4cm if Eckardt score >3
- Repeat 3.5-4cm if recurrence during follow-up

Heller’s myotomy
- Laparoscopic approach with Dor fundoplication
Management Of Achalasia – Pneumatic Dilation vs. Heller’s Myotomy

- Complications of treatment
  - Perforation
    - Pneumatic dilation (PD)
      - Esophageal perforation 4%
      - 3 perforations with 30mm, 1 with 35mm
      - 2 underwent surgery, 2 conservative care
    - Heller’s myotomy (HM)
      - Mucosal tear in 13/106 (12%)
      - Repaired during initial surgery
  - GERD
    - Increased acid exposure similar: 15% PD, 23% HM
    - Erosive esophagitis similar: 19% PD, 21% HM
- Conclusion
  - Effectiveness of PD is comparable to laparoscopic HM if allow for repeated dilations and accept risk of esophageal perforation
Management Of Achalasia – Per Oral Endoscopic Myotomy (POEM)

- Peroral esophageal myotomy
  - Originally described in porcine model by Pasricha
  - First described in a patient by Inoue at DDW 2009, followed by report of 17 patients
  - Now known as per oral endoscopic myotomy (POEM)
- Clinical results of POEM for achalasia
  - 300 consecutive cases in a single site prospective study in Japan
  - 2008-2012
  - 41 cases with sigmoid esophagus, 10 prior surgical failures
  - Success (Eckardt <3) in 98%
  - 5 cases received second POEM
  - Mean operating time 110 minutes
  - 9 complications: 1 pneumothorax, 1 hematoma, 1 peritonitis, 6 mucosal injuries
  - 5% received PPI post POEM
Management Of Achalasia – Endoscopic vs. Surgical Myotomy

- Prospective multicenter study of POEM
  - Compared to retrospective cohort of lap Heller’s myotomy
  - Primary outcome of symptom relief at 3 months
  - 70 patients underwent POEM
  - Mean operative time 105 minutes (54-240 min)
  - No conversions to open or lap surgery
  - Treatment success in 97% with POEM
  - POEM had significantly better 3 month symptom scores (1 vs. 1.4) and LES pressure (9 vs. 12 mmHg) compared to review of HM
  - Reflux esophagitis higher in POEM but not statistically significant (41% vs. 28%)

- Conclusions
  - Excellent outcomes of POEM are comparable to HM and reproducible in multiple centers
  - GERD complications may not be as significant as feared, perhaps due to avoidance of hiatal dissection
  - Growing experience supports effectiveness of POEM
  - POEM avoids surgical alteration of the EGJ morphology
  - POEM may become primary approach to treatment of achalasia
Secondary Achalasia

- Etiologies
  - Pseudoachalasia
  - Post fundoplication
  - Chagas’ disease
  - Eosinophilic esophagitis
  - Allgrove’s syndrome
  - Paraneoplastic syndrome
  - Parkinson’s disease
  - MEN IIB
  - Familial achalasia
  - Sjogren’s syndrome
  - Post vagotomy
  - Amyloidosis

*Mechanical obstruction can mimic the radiographic and manometric features of gastrointestinal dysmotility*
ESOPHAGEAL SYMPTOMS IN PATIENTS AFTER BARIATRIC SURGERY
The Bariatric Patient

- Bariatric surgery can affect the LES and the esophageal body
- Laparoscopic adjustable gastric band
- Laparoscopic sleeve gastrectomy
- Roux-en-Y gastric bypass
Lap Band

- Associated with:
  - weak esophageal motility
  - pouch dilatation
  - Increased LESP

- Can present as:
  - worsening GE reflux
  - esophageal stasis
  - achalasia-type symptoms
Laparoscopic Sleeve Gastrectomy

- Associated with:
  - weak LESP
  - decreased gastric compliance
  - disruption of EG junction competency
- Can present as:
  - worsening GE reflux
Roux-en-Y Gastric Bypass

- Can improve or worsen GE reflux disease
- Effect of weight loss on reduction in GERD symptoms
Live Long and Prosper