Esophageal Motility Disorders
Not Just Achalasia!

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Objectives

• Examine application of high-resolution manometry in the diagnosis of esophageal motility disorders

• Discuss diagnosis and treatment of non-achalasia esophageal motility disorders as defined by the v3 Chicago Classification
Evolution of Esophageal Manometry

1950s
First water-perfused catheters with few side holes

1990s
HRM with increased number of pressure sensors

Holloway. 2006, GI Motility Online
Esophageal Manometry

• Current catheters
  – Circumferential pressure sensors
  – 1 to 2cm apart
Esophageal Manometry

**Line plot**

**Color contour plot**
Esophageal Pressure Topography Plot

Pressure Amplitude
Esophageal Pressure Topography Plot

UES

LES
Chicago Classification

• 2008
  – Chicago Classification was developed
  – First official classification system
  – Based on several studies in healthy volunteers at Northwestern University

• 2012
  – Chicago Classification v2

• 2015
  – Chicago Classification v3

van Hoeij et al. 2016, J Neurogastroenterol Motil
The Chicago classification v3.0
Hierarchical analysis

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
   - No: Absent contractility
     - No scorable contraction
     - Consider achalasia

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

5. IRP normal and > 50% effective swallows
   - Yes: Minor disorders of peristalsis
     - Impaired clearance
   - No: Normal

Kahrilas et al. 2015, Neurogastroenterol Motil
Integrated Relaxation Pressure (IRP)

- Mean pressure of the EGJ during maximal relaxation in the 10 sec after the swallow
- LES pressure relaxation
Contractile Deceleration Point

- Contractile Deceleration Point (CDP)
  - Deceleration point where propagation velocity slows
Distal Latency

- Distal latency
  - Time from the onset of swallow to CDP (> 4.5 sec)
  - Metric of spastic contractions
Distal Contractile Integral

- Multiplication of amplitude x length x duration
- Measure of strength of contraction

Kahrilas et al. 2015, Neurogastroenterol Motil
Distal Contractile Integral

Failed
DCI <100

Weak
DCI 100-450

Hypercontractile
DCI > 8000

Kahrilas et al. 2015, Neurogastroenterol Motil
The Chicago Classification v3.0
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Kahrilas et al. 2015, Neurogastroenterol Motil
The Chicago classification v3.0
Hierarchical analysis

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)

Disorders with EGJ outflow obstruction

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Type I
No contractility

Type II
Panesoph pressurization

Type III
Esophageal spasm

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Kahrilas et al. 2015, Neurogastroenterol Motil
Boeckxstaens et al. 2014, Lancet
The Chicago classification v3.0

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Disorders with EGJ outflow obstruction

Kahrilas et al. 2015, Neurogastroenterol Motil
The Chicago classification v3.0

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       ▶ Consider achalasia
   - No: Consider achalasia

Kahrilas et al. 2015, J Neurogastroenterol Motil
Major Disorders of Peristalsis

**DES**
- ≥ 20% premature (DL < 4.5s)
- **Jackhammer esophagus**
- ≥ 20% DCI > 8,000 mmHg·s·cm
- **Absent contractility**
- No scorable contraction
- Consider achalasia
Distal Esophageal Spasm

- Normal IRP
- More than 20% of premature swallows (DL< 4.5)
- Previously known as “diffuse esophageal spasm”
Distal Esophageal Spasm

- CFV is a nonspecific and unreliable measure
- Can be variable within one subject
- Abnormal DL was consistently associated with dysphagia and chest pain
- CFV was omitted from most recent Chicago Classification

Kahrilas et al. 2015, J Neurogastroenterol Motil
Conklin. 2013, Neurogastroenterol Motil
Hypercontractile Esophagus

- At least two hypercontractile swallows (DCI > 8000)
- Jackhammer esophagus
Hypertensive Peristalsis

- Nutcracker esophagus
  - DCI 5000-8000 mm x Hgs x cm

- Asymptomatic controls
  - Sometimes have DCI >5000
  - Never have DCI > 8000

- DCI >8000 was found to be associated with:
  - Chest pain
  - Dysphagia
  - Positive response to treatment

- This diagnosis has been omitted from most recent version of Chicago Classification

Herregods TV et al. 2015, J Neurogastroenterol Motil
Van Hoeij et al. 2016, J Neurogastroenterol Motil
Management of Esophageal Spasm and Hypercontractile Esophagus

• The evidence is not strong

• Most of what we know is based on retrospective data reviews and small uncontrolled trials

• Studies often enrolled heterogeneous populations
Management

• Lifestyle Interventions
  – Avoid triggers
    ○ Cold fluids
    ○ Caffeine
    ○ Factors that increase GERD: Smoking, ETOH
    ○ Soft foods and liquids trigger fewer symptoms

• Acid Suppressant Medications
  – Trial of high dose PPIs should be considered in all patients

• Rule out and treat Eosinophilic Esophagitis

Calcium Channel Blockers

- Reduce LES pressure and peristaltic amplitude
- Nifedipine MR 10-20mg TID prn (B – 1 RCT)
- Diltiazem MR 60mg TID prn (B - 1 RCT)
- Side Effects: hypotension, bradycardia, edema
Nitrate Donors

- Nitrate donors reduce contractile amplitude and velocity

- Glycerin trinitrate 300mg SI TID prn (C)
- Isosorbide dinitrate 10-40μg PO QDay or TID (C)

- Short-acting or long-acting preparations

- Side Effects: Dizziness, Headache
Peppermint Oil

• Blocks Ca channels and decreases smooth muscle spasm

• Peppermint oil 1 capsule TID or PRN (C)

• One trial of 8 patients demonstrated that infusion of peppermint oil eliminated simultaneous contractions in DES

Pimental M et al. 2001, J Clin Gastroenterol
Roman et al. 2013, Gastroenterol Clin North Am
Phosphodiesterase Inhibitors

- Inhibit breakdown of NO → Increase NO → Sm muscle relaxation

- Sildenafil 20mg PO TID prn (C)
  - Short and long acting preparation

- Very expensive. Insurance may not cover

- SE: dizziness, headache
Pain Modulators

- Reduce symptoms by decreasing visceral hypersensitivity
- Central effects on anxiety and depression

- Trazodone 50-150mg QHS
  - Most studied (RCT)
  - Superior to isosorbide dinitrate

- Imipramine 25mg-100 QHS (C)

- Amitriptyline 25mg-100 QHS

- Side Effects:
  - Sedation, dizziness, constipation, QTc prolongation
Pain Modulators

• Start at low dose
• Increase gradually until
  – Clinical improvement occurs
  – SE become troublesome
  – Full dose reached

• Benefits may not be seen for 4-8 weeks

• Duration of treatment
  – Can continue treatment indefinitely
  – Consider taper after 6 - 12 months
Psychological Intervention

• As with other functional GI disorders patients may benefit from CBT or interpersonal therapy

• Patients learn to
  – Cope with symptoms by diverting attention away from GI symptoms
  – Addressing unhelpful thoughts and behaviors

• Single case study of successful treatment of esophageal spasm with biofeedback and self-regulation

Latimer PR. Biofeedback Self Regul. 1981
Botulinum Toxin

• Botulinum Toxin A inhibits release of ACh → muscle relaxation

• Botulinum toxin 80-200 IU
  – Endoscopic injection into GEJ and/or distal esophagus
  – Can be repeated when symptoms return

Achalasia.ca
Van Hoeij et al. 2016, Dis Esophagus
Marjoux S et al. 2013, Endoscopy
Botulinum Toxin

• Several studies (mostly small uncontrolled studies)
  – >6 month response in 50-100% of patients

• One RCT cross over study
  – 22 patients with non-achalasia esophageal hypermotility disorders
  – Botox 8 x 12.5 IU injections (2 and 7cm above GEJ)
  – Sham injections - saline
  – 4 week cross over design
Botulinum Toxin

- Improved motility
- Relieved dysphagia in ½ of patients
- Stabilized weight loss
- No significant effects on
  - Chest pain
  - GERD
  - Regurgitation

- 30% had a sustained response at 1yr

Jackhammer - before Botox

Jackhammer - 1 month after Botox

Side Effects of Botulinum Toxin

• Complications of botulinum toxin injections for treatment of esophageal motility disorders
  – 386 patients/661 procedures
  – Mild complications 7.9%
    ☐ Chest pain, heartburn, epigastric pain
  – No ulceration, perforation, pneumothorax
  – One patient died after developing mediastinitis - mycotic aneurysm

• Three case reports: mediastinitis, esophageal ulceration with necrosis, subdiaphragmatic abscess

Van Hoeij et al. 2016, Dis Esophagus
Marjoux S et al. 2013, Endoscopy
Dilation

• Pneumatic dilation has been proposed for treating of spastic esophageal disorders and some success has been reported

• Unclear if patients that benefited would have been more properly classified as having spastic achalasia

• Risk: 1% risk of perforation

Nair LA et al. 1993, Dig Dis Sci
Irving JD et al. 1992, Gastrointest Radiol
Surgery

• Myotomy with incision extending along the entire smooth muscle of the esophagus

• In one case series outcomes after surgery better than continued medical care

• No controlled studies

• Clinically significant morbidity in 5%

• No deaths

Patti MG et al. 1995, Arch Surg
Leconte M et al. 2007, Br J Surg
POEM

• PerOral Endoscopic Myotomy
  – Endoscopic equivalent of myotomy

• Effective and safe therapeutic modality for treatment of spastic esophageal disorders

Khan et al. 2017, Dig Dis Sci
POEM

- Meta-analysis of 8 observational studies
  - 179 patients
  - Improvement in dysphagia
    - DES (37 patients) – 88%
    - JH (18 patients) – 72%
  - Overall adverse event rate 14%
  - 3% of patients required subsequent intervention and/or prolonged hospitalization
  - High volume centers with experienced endoscopists

Khan et al. 2017, Dig Dis Sci
Absent Contractility

- Normal IRP
- 100% failed peristalsis - Scleroderma esophagus
Absent Contractility

- Systemic Sclerosis
- Other connective tissue disease
- DM
- Multiple Sclerosis
- In absence of systemic disease
Treatment of Absent Contractility

• Lifestyle modifications
  – Maintaining upright position after food ingestion
  – Dietary modifications

• Acid suppression

• Promotility agents are typically ineffective
The Chicago classification v3.0
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Kahrilas et al. 2015, Neurogastroenterol Motil
Minor Esophageal Disorders

- Significant overlap with patterns observed in normal controls
- Commonly associated with GERD
- Can be associated with abnormal bolus transit and dysphagia
- Clinical significance and direction of therapy remain unclear

Ineffective motility (IEM)
- ≥50% ineffective swallows

Fragmented peristalsis
- ≥50% fragmented swallows and not ineffective
Ineffective Esophageal Motility

- >50% of weak and/or failed swallows
  - Failed: DCI < 100mmHg/cms
  - Weak: DCI 100-450mmHg/cms

Interpretation of HRM Esophageal Manometry, Given Imaging
Fragmented Peristalsis

- >50% fragmented swallows
  - Large gaps in the isobaric contour
  - Associated with bolus escape in esophagus
Treatment of Minor Esophageal Disorders

• Control of acid reflux

• Lifestyle modification
  – Maintain upright position after pill ingestion
  – Modification of diet

• Pain modulator therapy for functional dysphagia
In Summary
Evolution of Esophageal Manometry

- Over recent years, esophageal manometry has become a remarkably sophisticated technique
Treatment

- DES/Jackhammer Esophagus
  - CCB, nitrate donors, peppermint oil, PDI, pain modulators
  - Botox
  - Extended myotomy
  - POEM
Treatment

- Absent Contractility
- Ineffective Motility/Fragmented Peristalsis
  - Acid suppression
  - Lifestyle and dietary modification
  - Pain modulator therapy can be considered in Ineffective Motility/Fragmented Peristalsis

- Further studies to better characterize esophageal motility disorders and guide treatment are needed
Thank you
Esophagus and Upper GI

• Barrett’s esophagus ablation – where are we a decade later?
  
  V. Raman Muthusamy, MD

• Endo GERD therapy – dead or alive?
  
  Gary Reiss, MD

• Esophageal motility disorders – not just achalasia!
  
  Monik Lammi, MD

• Treating achalasia – when to consider surgery and new options for therapy.
  
  James Wooldridge, Jr., MD
Case Presentations
Case 1

- 54 yo female with history of anxiety, IBS-D, HTN presenting with intractable vomiting
  - Symptoms started after gastric bypass one year ago
  - Vomiting occurs after every meal
  - Even a glass of water can trigger vomiting
  - Symptoms often associated with belching
  - Denies nausea
  - Vomitus tastes the same as ingested food
  - No improvement with various anti-emetics and PPIs

- Normal EGD, GES, CT of abd
Case

- Symptoms resolved with diaphragmatic breathing, CBT and TCA
Rumination Syndrome

• Functional gastrointestinal disorder characterized by effortless and repetitive regurgitation of recently ingested food
• Followed by either re-swallowing or spitting
Rumination Syndrome

- Patients report “vomiting” or “reflux” immediately after a meal (within 20 minutes)
- Can persist for 2 hours
- Symptoms occur with every meal
- Vomitus tastes the same as ingested food
- Often preceded by belching or burping
- Associated with abd pain due to diaphragmatic strain
- Usually no nausea or retching
- No response to antiemetic and GERD treatment
- No rumination at night or during sleep
• **Diagnosis**
  - High resolution manometry with impedance shows increase in intra-gastric pressure followed by regurgitation

Fox M. et al. 2012, Neurogastroenterol Motil
Treatment

- Patient education and reassurance
- Diaphragmatic breathing
- TCA
- Baclofen