Esophageal Symptoms

• Symptoms
  – Transit related- Antegrade and Retrograde
    • Food impaction
    • Regurgitation
    • Aspiration
    • Malnutrition
  – Perception related
    • Discomfort
      – Chest pain / pressure
      – Heartburn
      – Thermal
Esophageal Anatomy

- Incisor teeth
- Oropharynx
- Epiglottis
- Pharyngeal recess
- Thyroid cartilage
- Cricoid cartilage
- Cricopharyngeal muscle
- Aortic constriction
- Trachea
- Aorta
- Left main bronchus
- Cardiac part of stomach
- Inferior esophageal sphincter
- Diaphragm
- Inferior pharyngeal constrictor muscle
- Thyroid cartilage
- Cricoid cartilage
- Cricopharyngeus muscle (part of inferior pharyngeal constrictor)
- Trachea
- Esophagus
- Aorta
- Sternum
- Heart in pericardium
- Diaphragm
- T3, T4, T7, T9, T11, L1
Etiologies of Esophageal Symptoms

- Structural abnormality (dysphagia - usually solid food)
  - Endoscopy

- Ring
- Stricture
- Eosinophilic esophagitis
- Infectious esophagitis
- Pill or caustic esophagitis
- Dermatologic disorders
- Extrinsic compression
- Primary or secondary tumor
Etiologies of Esophageal Symptoms

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Etiologies of Esophageal Symptoms

Propulsive Disorder
(usually dysphagia for solids & liquids or GERD)
Functional Esophageal Tests
- Peristaltic weakness
- Aperistalsis
- Nutcracker/Jackhammer
- Spasm
- Achalasia
- Functional Obstruction
- GERD

Structural abnormality
(usually solid food only)
- Ring
- Stricture
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- Dermatologic disorders
- Cricopharyngeal bar
- Extrinsic compression
- Primary or secondary tumor

Sensory abnormality (solids & liquids)
- EGD Negative
- Functional
- Nonspecific EMD
- Psychological

Overlap with propulsive disorders and GERD
Functional Imaging of Esophageal Peristalsis

**MANOMETRY**

- Manometric port
- Manometric Sleeve

Graph showing pressure recordings in mmHg along the esophagus.
Functional Imaging of Esophageal Peristalsis

HIGH-RESOLUTION MANOMETRY
Functional Imaging of Esophageal Peristalsis

**ESOPHAGEAL PRESSURE TOPOGRAPHY**

![Clouse Plot](image)
Pressure Topography of Esophageal Motility

What does it add

• More akin to an imaging modality
  – Defines important anatomical landmarks and abnormalities.
  – Refines measurement of important motor events
    • *EGJ relaxation*
    • *Peristaltic velocity*
    • *Contractile activity*
  – Defines intra-luminal pressurization patterns
Esophageal Pressure Topography: The Method: Procedure

- Spans from the pharynx to the stomach with sensor separation of no more than a centimeter within and around the sphincters.
  - Greater than 32 pressure sensors
  - Temporal frequency response matched to the zone of the esophagus
- The immediate advantages of HRM are:
  - 1) a simplified procedural set up with improved sphincter localization,
  - 2) elimination of movement artifact
  - 3) simplified data interpretation and
  - 4) ability to perform more sophisticated analysis of esophageal function.

Sierra Scientific Instruments

Medical Measurement Systems

Sandhill Scientific Inc.
Pressure Topography of Esophageal Motility

The Chicago Classification

IRP ≥ upper limit of normal AND absent peristalsis

Yes

✓ Achalasia
  • Subtypes I, II, III

IRP ≥ upper limit of normal AND some instances of intact or weak peristalsis

Yes

✓ EGJ Outflow Obstruction
  • Achalasia variant versus mechanical obstruction

No

IRP is normal AND absent peristalsis

Yes

✓ Absent Peristalsis

IRP is normal AND reduced distal latency

Yes

✓ Diffuse esophageal spasm (DES)
  • ≥ 20% of swallows with reduced DL (<4.5 s)

No

IRP is normal AND Minor Peristaltic Abnormalities

Yes

*outside of normative range/clinical significance less clear

✓ Rapid contraction
  • ≥ 20% of swallows with rapid CFV (>9 cm/s) and normal DL

No

✓ Hypertensive Peristalsis
  • ≥ 20% of swallows with DCI > 5,000 mmHg-s-cm and normal DL

No

✓ Weak Peristalsis
  • ≥ 30% of swallows with small (2-5 cm) breaks in the 20-mmHg IBC
  • ≥ 20% of swallows with large (>5 cm) breaks in the 20-mmHg IBC

No

✓ Frequent Failed Peristalsis
  • ≥ 30% of absent swallows

✓ Normal

Neurogastroenterology and Motility, Vol 24; (Supplement 1) March 2012.
Pressure Topography of Esophageal Motility

The Chicago classification

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AND
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IRP ≥ upper limit of normal
AND
some instances of intact or weak peristalsis

Yes

✓ EGJ Outflow Obstruction
  • Achalasia variant versus mechanical obstruction
Clinical Evolution of Achalasias

Assessing clinically relevant phenotypes

Early
Type II or III

Chronic
Type II/III--I

Late
Type I
High-Resolution Manometry: Achalasia subtypes

**Type I**

IRP = 22.3 mmHg

5 seconds

**Type II**

IRP = 24.2 mmHg

5 seconds

**Type III**

IRP = 29.8 mmHg

5 seconds
High-Resolution Manometry: EGJ Outflow Obstruction

A: EGJOO: achalasia phenotype

- Locus of diverticulum above EGJ
- IRP = 22.3 mmHg

B: EGJOO: Mechanical

- Normal peristalsis
- Compartmentalized pressurization
- IRP = 27.2 mmHg

- Large diverticulum 4 cm above EGJ
- Barium tablet localized 12 mm restriction
## Response Rates of Achalasia Treatments

*Patients categorized by pressure topography subtype*

<table>
<thead>
<tr>
<th>Author</th>
<th>Subtype</th>
<th>No. patients (%)</th>
<th>Success rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pandolfino</td>
<td>I</td>
<td>21 (21.2)</td>
<td>56*</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>49 (49.5)</td>
<td>96*</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>29 (29.3)</td>
<td>29*</td>
</tr>
<tr>
<td>Salvador (LHM)</td>
<td>I</td>
<td>96 (39)</td>
<td>84.6</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>127 (51.6)</td>
<td>95.3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>23 (9.4)</td>
<td>69.3</td>
</tr>
<tr>
<td>Pratap (PD)</td>
<td>I</td>
<td>24 (47.1)</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>24 (47.1)</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>3 (5.8)</td>
<td>33.3</td>
</tr>
<tr>
<td>Rohof (PD &amp; LHM)</td>
<td></td>
<td></td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>44 (25)</td>
<td>85.7</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>114 (64.7)</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>18 (10.2)</td>
<td>40</td>
</tr>
</tbody>
</table>

LHM, laparoscopic heller myotomy; PD, pneumatic dilatation.

Rohof W, Gut 2011; 60 (Suppl 3)
Utilizing HRM/EPT in the Management of Achalasia

Symptoms of dysphagia ± chest pain and bland regurgitation

Upper Endoscopy

Obstructive process: ring, stricture, etc.
Normal
Esophageal dilatation
EGJ resistance
Retained food
Diverticulum

High Resolution Manometry
*esophagram may be helpful when manometry is technically difficult to perform

EPT Diagnosis

EGJ Outflow Obstruction
• EGD ± EUS/CT to rule out obstructive process
• Potentially achalasia phenotype with preserved peristalsis

Absent Peristalsis
• If clinical scenario c/w achalasia, a timed barium esophagram should be performed
• Potentially advanced GERD or scleroderma
• Potentially achalasia phenotype with hypotensive LES

Achalasia I
• Severe dilatation is associated with poor treatment response
• Consider myotomy as initial therapy

Achalasia II
• Best treatment response
• Esophagram can be normal without barium retention or esophageal dilatation
• Frequently misdiagnosed with conventional manometry

Achalasia III
• Worst treatment response
• May benefit from treatment directed at spasm
• Often diagnosed as DES on esophagram

DES
• Extremely rare
• Difficult to treat
• Many cases are misdiagnosed Type III achalasia
ACHALASIA: Treatment Options

• Medication
  - Nitrates
  - Calcium channel blockers
  - Phosphodiesterase inhibitors (sildenafil, etc.)

• Botulinum toxin injection

• Pneumatic dilation

• Laparoscopic Heller myotomy

• Emerging Treatments
  - Peroral endoscopic myotomy (POEM)
  - Endoscopic stents
Pneumatic Dilation versus Laparoscopic Heller’s Myotomy for Idiopathic Achalasia

**Figure 2.** Kaplan–Meier Curves for the Rate of Treatment Success.

**B  Success Rate, Modified Intention-to-Treat Analysis**

P = 0.61 by log-rank test

**Months**

Success Rate (%)
Per Oral Endoscopic Myotomy (POEM)
Summary

• Achalasia can be more accurately defined and subtyped into clinically relevant phenotypes that may alter management.
• Patterns can define potential therapeutic options.
• New techniques are evolving that can tailor therapy based on subtype.
Pressure Topography of Esophageal Motility

*The Chicago classification*

- IRP is normal **AND**
  - absent peristalsis
  - **OR** reduced distal latency
  - **OR** DCI > 8,000 mmHg-cm-s

- ✓ Absent Peristalsis
- ✓ Diffuse esophageal spasm (DES)
  - ≥ 20% of swallows with reduced DL(<4.5s)
- ✓ Jackhammer esophagus
  - ≥ 20% of swallows with DCI > 8,000 mmHg-s-cm and normal DL
A) Normal: No breaks/ NL DCI

B) Jackhammer: No breaks/ Abnormal DCI

C) Absent Peristalsis

D) Absent/Failed Peristalsis

E) Weak Peristalsis- IEM

F) Weak Peristalsis- TZ Defect
Conclusion: Hypertensive Contractility

• There is no clear discriminator of symptomatic hypercontractility.
  – Propagation can appear normal
  – Therapy focused on reducing peristaltic amplitude in altering symptoms is extremely limited.
    • Smooth muscle relaxants
    • BoToX
  – Many patients may respond to treating visceral sensitivity
A: Latency described with conventional manometry

B: Latency measured with EPT
Normal swallow

C: DES: Rapid Premature Contraction
DL = 4.4 s
CFV = 6 cm/s

D: DES: Premature Contraction

E: Rapid Contraction with Normal latency
CFV = 15 cm/s
DL = 7.0 s
Conclusions: Spasm

• There is a difference between rapid contractions and spastic contractions.
  • Does the contraction occur too early [latency]?
  • Should consider whether contraction is altered by deglutitive inhibition.
  • A trial of smooth muscle relaxants is warranted in patients with true spasm and treatment similar to achalasia may be warranted.
Pressure Topography of Esophageal Motility

The Chicago classification

- **Rapid contraction**
  - ≥ 20% of swallows with rapid CFV (>9 cm/s) and normal DL

- **Hypertensive Peristalsis**
  - ≥ 20% of swallows with DCI > 5,000 mmHg-s-cm and normal DL

- **Weak Peristalsis**
  - ≥ 30% of swallows with small (2-5 cm) breaks in the 20-mmHg IBC
  - ≥ 20% of swallows with large (>5 cm) breaks in the 20-mmHg IBC

- **Frequent Failed Peristalsis**
  - ≥ 30% of absent swallows

**IRP is normal AND Minor Peristaltic Abnormalities outside of normative range/clinical significance less clear**

*outside of normative range/clinical significance less clear*
Peristaltic Defect

Gaps in the peristaltic wavefront

length along esophagus (cm)

Pressure (mmHg)

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34

time (s)

X = 7.1 cm

T = 3.5 s

Pill Esophagitis with Chest Pain
Transition Zone Defect
Patient with retrosternal discomfort (heartburn/chest pain) or regurgitation

- **Alarm features?**
  - no → **PPI Trial**
  - yes → **EGD ± biopsy**

- **EGD ± biopsy**
  - no → **pH or impedance-pH monitoring (off of PPIs)**
  - yes → **Esophagitis EoE**

- **Esophagitis EoE**
  - no → **>5% esophageal acid exposure?**
  - yes → **NERD**

- **>5% esophageal acid exposure?**
  - no → **Esophageal manometry**
  - yes → **Positive symptom association?**

- **Positive symptom association?**
  - no → **Reflux disease: titrate PPI therapy**
  - yes → **NERD**

- **NERD**
  - no → **Achalasia DES**
  - yes → **Meets esophageal motor disorder criteria?**

- **Meets esophageal motor disorder criteria?**
  - no → **Functional Heartburn/Chest Pain**
  - yes → **NERD**

Kahrilas PJ & Smout AJPM. Am J Gastroenterol 2010;105:747
Medical Management

**NOT FDA APPROVED**

- Anti-depressants
  - amitriptyline, nortriptyline, desipramine
    - 10 to 25 mmg at bedtime with escalation of 10 to 25 mg increments to a target of 50-75 mg
  - Trazadone
    - 25mg QHs up to 100 mgHg
  - SSRIs
- 5HT agonists-antagonists- not currently available
Gut-directed Hypnotherapy

Are you getting sleepy?

- Deep physical relaxation and deep mental concentration
- Alters focus of attention, changes meaning about sensations arising from the gut and encourages body to restore itself to a healthier state
- Shown to produce cognitive change and improve pain tolerance
- Modifies physiological arousal and hypersensitivity over long-term
- Initially performed in a doctors office but can eventually be self-guided
- The most scientifically supported non-drug treatment for Functional GI disorders
Globus: Definition

- **Globus Sensation**
  - Persistent or intermittent, nonpainful sensation of a lump or foreign body in the throat
  - Occurrence of the sensation between meals
  - Absence of dysphagia or odynophagia

- **Rome III: Functional Esophageal Disorders**
  - Absence of evidence that gastroesophageal reflux is the cause of the symptom
  - Absence of histopathology-based esophageal motility disorders
  - Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis.

Galmiche et al. Gastroenterology 2006;130:1459
Patient with sensation of a lump in the throat

History/Physical Exam

Laryngoscopy

Abnormal

Treat

Laryngoscopy

Normal/LPR

Low threshold for treating GERD

No Response

Endoscopy

Negative

1-HRM
2-pH study
off medication

DX: GERD
Titrate dose

Response

Dx: GERD

Re-evaluate at 1 year

Abnormal

Dx: GERD

Optimize TX

Treat Cause

DX: Achalasia
-DES
-Absent Peristalsis

Negative

-Positive pH Study

Optimize TX

No response

pH-MII
on PPI

Negative

DX: Refractory GERD

Abnormal

Lee et al. WJG 2012;18: 2462
Kahrilas PJ & Smout AJPM. Am J Gastroenterol 2010;105:747
Approach to Patients with Esophageal Diseases

• **Key Clinical Take Home Points:**
  
  – Esophageal symptoms can have a number of overlapping etiologies and the interaction between organic and functional influence should not be ignored.
  
  – Most of these disorders can be managed by a careful systematic evaluation that focuses on ruling out the most dangerous causes first and then focusing on the most likely cause.
  
  – Diagnose and treat in parallel.