Esophageal Dysmotility: New Approaches to Old Diseases

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Disclosures

• Consultant
  – Boston Scientific
  – Medtronic
  – Obalon

• Equity
  – Veritract
Outline

• Old diseases
  – GERD
  – Achalasia

• New Approaches
  – Diagnosis
    ● Bravo/Impedance/pH
    ● HREM
  – Treatment
    ● Achalasia
      – Botox, PD/LHM, POEM
    ● GERD
      – TIF, Magnetic sphincter augmentation
# Achalasia: Clinical Presentation

## Symptoms
- Dysphagia: 90-100%
- Heartburn: 75%
- Vomiting/Regurg: 45%
- Chest pain: 20%

## Associated Symptoms
- Cough/asthma: 20-40%
- Chronic aspiration: 20-30%
- Hoarseness/Sore throat: 33%
- Weight loss: 10%

## Differential
- Refractory GERD
- EoE
- Motility disorders
  - Absent contractility
  - DES
  - EGJOO
  - Jackhammer
- Pseudoachalasia
- Too tight Surgery
  - Fundo
  - Lap Band
GERD Definition

GERD is a condition which develops when the reflux of stomach content causes troublesome symptoms and/or complications.

- **Esophageal syndromes**
  - Symptomatic syndromes
    - Typical reflux syndrome
    - Reflux chest pain syndrome
  - Syndromes with esophageal injury
    - Reflux esophagitis
    - Reflux stricture
    - Barrett’s esophagus
    - Adenocarcinoma

- **Extra-esophageal syndromes**
  - Established association
    - Reflux cough
    - Reflux laryngitis
    - Reflux asthma
    - Reflux dental erosions
  - Proposed association
    - Sinusitis
    - Pulmonary fibrosis
    - Pharyngitis
    - Recurrent otitis media
New Approaches

Diagnosis

• Old:
  – Esophagram
  – EGD

• New
  – HREM
  – Bravo
  – Impedance/pH
  – Endoflip

Treatments

• Achalasia
  – Old: Botox, PD/LHM
  – New: POEM

• GERD
  – Old: PPI’s = fundo
  – New
    • TIF
    • Magnetic Augmentation
EGD: Esophagogastroduodenoscopy

- Best test dysphagia
- Diagnostic
  - Mucosal biopsies
  - Cytology
- Therapeutic
  - Dilation
  - Injection
  - Stent
  - NOTES
- Ultrathin, EUS
New Approaches: High-Resolution Manometry Catheter

• 36 circumferentially sensitive pressure sensors
  – Each sensor has 12 pressure sensitive segments
• Positioned from hypopharynx to stomach
• Evaluation of esophageal motor/motility disorders
• Usually after endo, Ba studies
Deglutative LES Relaxation
UES Relaxation
Proximal Peristalsis
Striated Muscle Contraction
Distal Peristalsis
Smooth Muscle Contraction
Swallow
UES Constriction
Eosophageal Body Contraction
Deglutative LES Relaxation
LES Relaxation
LES Restoration
Proximal Peristalsis
Striated Muscle Contraction
Distal Peristalsis
Smooth Muscle Contraction
Swallow
UES Constriction
Eosophageal Body Contraction
Deglutative LES Relaxation
LES Relaxation
LES Restoration
Chicago Classification of Esophageal Motility

Hierarchical Analysis of Esophageal Motility

The Chicago Classification

1. IRP ≥ upper limit of normal AND absent peristalsis
   Yes
   - Achalasia
     - Type I: classic
     - Type II: with esophageal compression
     - Type III: peristaltic fragments or spastic
   No

2. IRP ≥ upper limit of normal AND some instances of intact or weak peristalsis
   Yes
   - EGJ Outflow Obstruction
     - Achalasia variant
     - Mechanical obstruction
     - May have 1° or 2° hypercontractility
   No

3. IRP is normal AND absent peristalsis
   OR reduced distal latency
   OR DCI > 8000 mmHg-s-cm
   Yes
   - Absent Peristalsis
     - Distal Esophageal Spasm (DES)
       - ≥ 20% of swallows with reduced latency
     - Hypercontractile (Jackhammer) Esophagus
       - Any swallow with DCI > 8000 mmHg-s-cm
   No

4. IRP is normal AND Peristaltic abnormalities
   Yes
   - Weak Peristalsis
     - Large or small breaks in the 20-mmHg isobaric contour
   No
   - Frequent Failed Peristalsis
     - Hypertensive Peristalsis (Nutcracker Esophagus)
     - Rapid Contraction
       - ≥ 20% of swallows with rapid contraction
   Normal

Neurogastroenterol Motil (2012) 24 (Suppl. 1), 57–65
New Evaluation Methods: Impedance

No bolus = decreased ion conductivity = high impedance

Bolus present = increased ion conductivity = low impedance

Air
Esophageal Lining
Saliva
Food
Refluxate
Intraluminal Impedance

Multiple rings on the catheter allow for detection of bolus movement.
Multi-channel impedance

MII detected reflux episode

Example 1

Retrograde
Acid Reflux with Impedance
Acid Reflux with Impedance
HRM with Impedance Isocontour

Bolus Transit

Intact Swallow

Complete Bolus Clearance

Bolus present

Bolus absent

Hypotensive Swallow

Bolus Escape

3.0 cm
Achalasia Endoscopy

- Normal
  - r/o EoE

- Dilated
  - Foamy saliva
  - Retained food
  - No stricture

- Puckered GEJ
  - Mild resistance LES

- Pseudoachalasia
  - Retroflex!
  - EUS/CT
New HRM criteria: Classic achalasia

- Type I
- Absent peristalsis
- IRP > 15 mmHg
- Minimal esophageal pressurization
- “Classic achalasia”
New HRM criteria: achalasia with esophageal compression

- Type II
- Absent peristalsis
- IRP > 15 mmHg
- ≥ 20% Pan-esophageal pressurization
- Best Rx response
New HRM criteria: Spastic achalasia

- Type III
- Absent peristalsis
- IRP > 15 mmHg
- > 20% swallows w/spasm
  - Distal latency < 4.5s
- Worst Rx response
Achalasia Treatment

• Goals
  – Relieve symptoms
    • w/o GERD
  – Improve esophageal emptying
  – Prevent longterm complications
    • Mega-esophagus
    • Squamous cell CA

• Treatments
  – Pneumatic Dilation
  – Laparoscopic Heller Myotomy
  – POEMS
  – Palliation
    • Drugs
    • Botox
    • PEG/Stenting
Botox Disadvantages

- Relatively ineffective
- Temporary
  - Repeat w/shorter duration response
- Doesn’t halt progression
- Role
  - Diagnostic/therapeutic trial
  - High co-morbidities
    - Life expectancy < 2 yrs
Pneumatic Dilation

- Clear liquid diet for 24-72 hours, then NPO
- Inflate balloon until waist ablated (~8-15 psi)
- Optimal inflation time (or #) not established 15-60 sec
- Contrast esophagogram p-dilation
  - Repeat endo immediately post-dil
- Response rate 60-90%
- Perforation rate <2%
Pneumatic Dilation versus Laparoscopic Heller’s Myotomy for Achalasia

• No difference 2 yrs
  – Success: Eckardt score ≤ 3
  – LES pressure
  – QOL

• Complications
  – PD: Perforation 4%
  – LHM: mucosal tears 12%
  – Abnl acid exposure
    ● LHM 23%
    ● PD 15%

Long-term results LHM vs. PD

- No diff at 5 yrs
  - Symptoms
  - Emptying
  - GERD

- Per Protocol success
  - 82% LHM
    - 12 mucosal tears 11%
    - 34% abnl AE
  - 91% PD
    - 5 perfs (2%)
    - 25% re-dilation
    - 12% abnl AE

Gut 2015;0:1–8.
Major complications of Pneumatic Dilation for achalasia

Relationship between study and perforation rate following PD

Am J Gastroenterol 2012; 107:1817–1825
Per Oral Endoscopic Myotomy: POEMS

Technique

• Pasricha 2007 Inoue 2010
• Gain access to SM space
• Long submucosal tunnel
• Myotomy with needle knife
  – 6 cm esophagus
  – 2 cm stomach
• Close mucosal entry site w/clips

Endoscopy. 2007 Sep;39(9):7614
# POEM long term efficacy

<table>
<thead>
<tr>
<th>Total subject number</th>
<th>Follow-up (months)</th>
<th>Clinical success</th>
<th>Eckardt score (before/after)</th>
<th>LES pressure (mmHg) (before/after)</th>
<th>Clinical GERD (symptomatic or PPI use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inoue et al[38]</td>
<td>500</td>
<td>Over 36</td>
<td>88.5% (54/61)</td>
<td>28.7/14.0</td>
<td>21.3%</td>
</tr>
<tr>
<td>Hu et al[40]</td>
<td>32 (Sigmoid type)</td>
<td>30 (median)</td>
<td>96.8% 7.8/1.4</td>
<td>37.9/12.9</td>
<td>25.8%</td>
</tr>
<tr>
<td>Chen et al[41]</td>
<td>26 (pediatric patients)</td>
<td>24.6 (mean)</td>
<td>100% 8.3/0.7</td>
<td>31.6/12.9</td>
<td>19.2%</td>
</tr>
<tr>
<td>Sharata et al[35]</td>
<td>75</td>
<td>20.1 (mean)</td>
<td>97% 6/1</td>
<td>22.2/11.7</td>
<td>19.1%</td>
</tr>
<tr>
<td>Minami et al[32]</td>
<td>28</td>
<td>16 (median)</td>
<td>100% 6.7/0.7</td>
<td>71.2/21</td>
<td>21.4%</td>
</tr>
<tr>
<td>Teitelbaum et al[19]</td>
<td>41</td>
<td>15 months (median)</td>
<td>92% 7/1</td>
<td>28/11</td>
<td>15%</td>
</tr>
<tr>
<td>Von Renteln et al[39]</td>
<td>70</td>
<td>12 (median)</td>
<td>82.4% 6.9/1</td>
<td>27.6/8.9</td>
<td>29%</td>
</tr>
</tbody>
</table>

## Comparison of techniques

<table>
<thead>
<tr>
<th></th>
<th>POEM</th>
<th>LHM</th>
<th>PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scarring</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Selective circular myotomy</td>
<td>Possible</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Concurrent anti-reflux procedure</td>
<td>No</td>
<td>Fundoplication</td>
<td>No</td>
</tr>
<tr>
<td>Dissection and disruption of the diaphragmatic hiatus</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Postoperative incidence of GERD</td>
<td>(+++)</td>
<td>(++)</td>
<td>(+/-)</td>
</tr>
<tr>
<td></td>
<td>Symptomatic GERD</td>
<td>Symptomatic GERD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>approximately 20-30%</td>
<td>approximately 15%</td>
<td></td>
</tr>
<tr>
<td>Myotomy extension to the proximal esophageal body</td>
<td>Possible</td>
<td>Difficult</td>
<td>Impossible</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>Intermediate</td>
<td>Relatively long</td>
<td>Very short</td>
</tr>
<tr>
<td>Cost</td>
<td>Intermediate (variable according to region)</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Clinical response for achalasia</td>
<td>Good (excellent)</td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>Clinical response for spastic esophageal disorders</td>
<td>Good</td>
<td>Fair</td>
<td>Poor</td>
</tr>
</tbody>
</table>

Hypotensive LES with Hiatal Hernia
Laparoscopic fundoplications

Complete

Partial

Nissen

Dor

Toupet
RCT comparing PPI with surgical therapy for reflux oesophagitis

“For control of heartburn and regurgitation, studies suggest modest superiority of antireflux surgery to PPI therapy, on the order of a 10% gain.”

Br J Surg 2008 94: 198-203
Magnetic Sphincter Augmentation for GERD
Esophageal Sphincter Device for GERD

Table 1. Components of Esophageal pH Measurements.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>1 Year</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Patients</td>
<td>No. of Patients</td>
<td>Median Value</td>
</tr>
<tr>
<td>pH &lt; 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total percentage of time</td>
<td>100</td>
<td>96</td>
<td>10.9</td>
</tr>
<tr>
<td>Percentage of time upright†</td>
<td>100</td>
<td>96</td>
<td>12.7</td>
</tr>
<tr>
<td>Percentage of time supine‡</td>
<td>98</td>
<td>96</td>
<td>6.0</td>
</tr>
<tr>
<td>Total no. of reflux episodes</td>
<td>100</td>
<td>96</td>
<td>161.0</td>
</tr>
<tr>
<td>No. of reflux episodes lasting &gt;5 min</td>
<td>99</td>
<td>96</td>
<td>12.0</td>
</tr>
<tr>
<td>Longest reflux episode (min)</td>
<td>99</td>
<td>96</td>
<td>29.0</td>
</tr>
<tr>
<td>DeMeester score†</td>
<td>97</td>
<td>96</td>
<td>36.6</td>
</tr>
</tbody>
</table>

NEJM 2013 May 23;368(21):2039-40
Clin Gastro Hepatol 2015. Epub
Magnetic sphincter augmentation
Transoral Incisionless Fundoplication

• Fundo more effective medical rx
  – Invasive
  – Side effects

• TIF
  – Endo partial fundo
  – Less invasive
  – Fewer side effects

*Am J Gastro* 2015; 110:531–542
Conclusion

- Esophageal dysmotility diseases common
- New technologies for evaluation and treatment of GI motility disorders
  - Applicable to other GI diseases
  - ? Applicable to non-GI diseases