Esophageal Motility Disorders

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Relevant Disclosures

• Consultant: Medtronic
Selected Abstracts

1. FLIP Panometry in Achalasia: Useful?
   Rooney, KP et al. Distension-induced contractility is frequently present, but consistently abnormal in achalasia: a study utilizing FLIP panometry. DDW session #1145.

2. To POEM or not to POEM? That is the question.
   DeWitt JM et al. Prospective evaluation of risk factors for gastroesophageal reflux disease by ambulatory wireless pH monitoring after per-oral endoscopy myotomy. DDW #1147.
Study #1

Rooney KP et al.

Distension-induced contractility is frequently present, but consistently abnormal in achalasia: a study utilizing FLIP panometry.

DDW #1145.
Background: Esophageal Function

• Esophageal peristalsis
  – A propagated wave of contraction sweeping down the esophagus at a standard rate of cm/second
  – Coordinated
    • Central nervous system in striated muscle portion
    • Central and enteric nervous systems in smooth muscle portion
  – Secondary peristalsis to clear refluxed stomach contents

• Upper esophageal sphincter (UES) and lower esophageal sphincter (LES)
  – Tonic contraction
  – Timed opening with swallow reflex
Traditional Tools: Esophageal Peristalsis

- **Barium esophagram study**
  - Non-invasive evaluation
  - Primary wave of peristaltic contraction can be examined
  - Can apply official emptying metrics
  - Generally not considered accurate enough to make confident diagnosis of primary motility disorder

- **Upper endoscopy**
  - Can subjectively comment on appearance of peristaltic waves or spastic contractions
  - There are standardized methods of examining the esophagogastric junction (EGJ)

- **Esophageal manometry**
  - For decades has been accepted as most accurate examination of esophageal motility
Esophageal Manometry: Line Tracings

- Pharynx
- Upper esophageal sphincter (UES)
- Esophagus
- Lower esophageal sphincter (LES)
Esophageal High Resolution Manometry (HRM)

- Chicago Classification
  - Accepted system for defining esophageal motility
  - Currently based on ten 5 mL swallows
  - Performed in supine position
  - Version 3.0 is a refinement of prior versions
Background: Achalasia

- Esophageal motility disorder
  - Most well-described primary disorder

- Etiology
  - Current prevailing theory: neural degeneration as a progressive autoimmune process initiated by an indolent viral infection in a genetically susceptible patient

- Defining characteristics
  - Complete loss of normal peristalsis
  - Failure of adequate LES relaxation
Subtypes of Achalasia

A. EGJ outflow obstruction
   Impaired LES relaxation
   Normal or impaired peristalsis

B. Type II achalasia
   Impaired LES relaxation
   Absent peristalsis
   Increased pan-esophageal pressure

C. Type I achalasia
   Impaired LES relaxation
   Absent peristalsis
   Normal esophageal pressure

D. Type III achalasia
   Impaired LES relaxation
   Absent peristalsis
   Distal esophageal spastic contractions

Smooth muscle innervation
- Postganglionic excitatory neuron
- Postganglionic inhibitory neuron

Color pressure scale, mm Hg
0 30 60 90 120 150 180

10 s 5 s 5 s 10 s

Pandolfino JE et al. JAMA 2015
Alternative to Manometry?
Beyond HRM: Esophageal Motility

- Functional lumen imaging probe (FLIP)
  - Balloon-tipped catheter that can be placed on endoscopy
  - Uses *impedance planimetry* sensors mounted on the catheter
    - Balloon filled with conductive fluid, voltage measured across paired impedance sensors to ultimately provide measurement of cross sectional area and thus diameter in the lumen
    - Simultaneously pressure is measured and thus distensibility can be measured
  - Original proposed utilities
    - Included evaluating EGJ distensibility in esophageal motility disorders and GERD

**Analysis**

\[
\text{EGJ-DI} = \frac{\text{Narrowest CSA}_{\text{EGJ}}}{\text{intra-balloon pressure}}
\]

**Achalasia**

- Reduced EGJ-DI\(^{1,2}\)
  - Untreated
    - EGJ
      - 1.05 mm\(^2\)/mmHg
  - Good treatment response
    - EGJ
      - 7.10 mm\(^2\)/mmHg
  - Poor treatment response
    - EGJ
      - 0.33 mm\(^2\)/mmHg

Carlson DA et al. Am J Gastroenterol 2016
FLIP for Esophageal Motility

- Diameter topography
  - FLIP balloon (16 cm) inserted under sedation
    - Balloon slowly filled as per protocol
    - Patterns of contractions observed over time in patients with non-obstructive dysphagia
  - Contractions presumably from secondary peristaltic and other mechanisms

Carlson DA et al. Am J Gastroenterol 2016
Contractile Patterns

- RACs
- Absent Contractility
- Contractility No RACs or RRCs
- RRCs

Carlson DA et al. Am J Gastroenterol 2016
FLIP Topography

Dysphagia
HRM
N = 145

Abnormal
n = 111 (76%)
• Achalasia: 70 (48%)
• EGJOO: 38 (26%)
• Jackhammer: 3 (2%)

Normal
n = 34 (23%)
• IEM: 5 (3%)
• Normal motility: 29 (20%)

Abnormal
n = 106 (95%)
HRM Dx (% HRM dx):
• Achalasia: 70 (100%)
• EGJOO: 33 (87%)
• Jackhammer: 3 (100%)

Normal
n = 5 (5%)
HRM Dx (% HRM dx):
• EGJOO: 5 (13%)

Abnormal
n = 17 (50%)
HRM Dx (% HRM dx):
• IEM: 2 (40%)
• Normal motility: 15 (52%)

Normal
n = 17 (50%)
HRM Dx (% HRM dx):
• IEM: 3 (60%)
• Normal motility: 14 (48%)

Carlson DA et al. Am J Gastroenterol 2016
# FLIP Panometry

Table 2. The Endoflip™ Impedance Planimetry System Panometry diagnoses and disease states.

For application to endoscopy-negative dysphagia patients without a hernia > 3 cm or mechanical obstruction/esophagitis. EGJ-distensibility Index (DI) at EF-322 60 mL fill volume or EF-325 40 mL fill volume. Clinical suspicion reflected by color intensity: Red – consider achalasia. Blue – consider GERD. Green – consider a spastic disorder.

<table>
<thead>
<tr>
<th>EGJ-DI</th>
<th>EGJ-DI</th>
<th>EGJ-DI</th>
<th>EGJ-DI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 mm²/mmHg</td>
<td>2.1-3.0 mm²/mmHg</td>
<td>3.1-9.0 mm²/mmHg</td>
<td>&gt; 9.0 mm²/mmHg</td>
</tr>
<tr>
<td>Max D &lt; 12 mm Bag pressure &gt; 20 mmHG</td>
<td>Max D &gt; 12 mm Bag pressure &gt; 20 mmHG*</td>
<td>Normal contractile response</td>
<td>Normal contractile response with increased EGJ distensibility</td>
</tr>
<tr>
<td>RACs</td>
<td>EGJOO with normal contractile response</td>
<td>EGJOO with normal contractile response</td>
<td>Normal contractile response</td>
</tr>
<tr>
<td>DDCR</td>
<td>EGJOO w/ DDCR</td>
<td>EGJOO w/ DDCR</td>
<td>DDCR</td>
</tr>
<tr>
<td>Absent</td>
<td>EGJOO w/ absent contractile response</td>
<td>EGJOO w/ absent contractile response</td>
<td>Absent contractile response with increased EGJ distensibility</td>
</tr>
<tr>
<td>RRCs</td>
<td>EGJOO w/ retrograde contractile response</td>
<td>EGJOO w/ retrograde contractile response</td>
<td>Retrograde contractile response with increased EGJ distensibility</td>
</tr>
</tbody>
</table>

*Rule out mechanical stricture if Max diameter is less than 18 and there is a fixed plateau max diameter during volumetric distention. Disordered and/or diminished contractile response (DDCR), Repetitive Antegrade Contractions (RACs), Repetitive Antegrade Contractions (RRCs)

Pandolfino JE et al. ‘Medtronic Review White Paper’ 2018
Study #1

• How often is there still some contractility in achalasia?

• Can FLIP panometry assess and subtype achalasia reliably?

• Aim of study: to compare contractility in achalasia patients compared to that seen in normal controls, in order to demonstrate the former is consistently abnormal
Methods

• 140 newly diagnosed and treatment-naïve patients with achalasia
  – 21% type I, 58% type II, 21% type III
  – 39% female, mean age 51

• 20 asymptomatic controls
  – 95% normal peristalsis on HRM
  – 70% female, mean age 30

• All patients had HRM and FLIP Topography
Results

- At all FLIP volumes
  - All (100%) control patients had RAC pattern
  - Minority (20%) of achalasia patients had RAC pattern
    - Only 11 (8%) had a RAC pattern without an RRC pattern
      - These still had abnormal characteristics
Example RAC in Achalasia
Conclusions

• Distension-induced contractility was present in achalasia, even in some patients without contractility on HRM, but it was not ‘normal’ and specific characteristics were observed.

• The contractile characteristics can be applied to aid defining normal versus abnormal contractile response to achalasia as assessed with FLIP panometry.

• Future directions
  – Apply to FLIP panometry in patients without achalasia on HRM
  – Assess for prognostic or management implications in achalasia.
Study #2

DeWitt JM et al.

Prospective evaluation of risk factors for gastroesophageal reflux disease by ambulatory wireless pH monitoring after per-oral endoscopy myotomy.

DDW #1147.
Achalasia Treatment

- Short-term options
  - Botulinum toxin
  - Medications

- Potential “definitive” options
  - Pneumatic dilation (PD)
  - Laparoscopic Heller myotomy (LHM) with partial fundoplication
  - Peroral endoscopic myotomy (POEM)
Comparing Treatments

- Recent meta-analysis comparing treatments by subtype in 1575 achalasia patients
  - POEM best for type I and type III achalasia
  - PD, LHM and POEM equivalent for type II achalasia

GERD Following Treatment

- PD with relatively low frequency
  - 15% at one year by pH study in one major achalasia trial

- LHM done with partial fundoplication to decrease incidence of GERD

- What about POEM?
  - Meta-analysis comparing LHM (2581 patients) to POEM (1582 patients)
    - Higher rates of GERD by esophagitis, pH-metry or symptom analysis
    - Studies heterogeneous without standardization
  - Not much is known about predictive factors for post-POEM GERD
    - This could help decide who should get POEM

Repici A et al. Gastrointest Endosc 2018
Study #2

• Aims

– To report the risk of GERD by ambulatory pH monitoring after POEM in a standardized fashion

– To stratify risk of GERD by treatment response to Eckardt score, manometry IRP, FLIP DI, BMI and symptoms of heartburn
Methods

• Prospective study of POEM patients at one institution

• Baseline
  – Symptom scores
  – Upper endoscopy with FLIP
  – Esophageal HRM

• Six months after POEM
  – Symptom scores
  – Upper endoscopy with FLIP and wireless pH capsule placement (48-hour study) off acid suppressive therapy
  – Esophageal HRM
Results

• 115 consecutive POEM patients

• 48 patients had 6 month testing after POEM
  – Type I achalasia 9 (18.8%)
  – Type II achalasia 31 (64.6%)
  – Type III achalasia 2 (4.2%)
  – Other motility disorders 6 (12.5%)
GERD after POEM

- Esophagitis in 33/48 (69%)
- pH testing in 37 patients
  - Positive for GERD in 20/37 (54%) by DeMeester score being high overall on 48-hour study
  - Higher pH scores → more likely to have significant esophagitis
    • But not necessarily more likely to have heartburn
    • Not associated with BMI, FLIP DI, manometry IRP or Eckardt score
Conclusions

- POEM has a high degree of GERD measured by esophagitis or pH testing

- The GERD does not appear associated with symptomatic heartburn or variables on manometry or FLIP

- Large scale studies are needed to identify factors leading to GERD after POEM
Thank You

Questions?