Core Lecture: Esophageal Motility Disorders

John M. Wo, M.D.
Division of Gastroenterology/Hepatology
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Core Lecture:
Esophageal Motility Disorders

• Normal esophageal anatomy and physiology
• Evaluation of esophageal function
• Classification of esophageal motility disorders
  – Hypercontracting and hypocontracting esophagus
• Specific esophageal motility disorders
Symptoms Suggesting Esophageal Origin

• Esophageal
  – Heartburn
  – Regurgitation
  – Dysphagia
  – Odynophagia
• Other
  – Atypical GERD (shortness of breath, cough, hoarseness, throat clearing, sore throat, globus, etc.)
  – Chest pain
  – Aspiration
  – Weight loss
• Any vagal or myenteric neuropathy may result in esophageal motility disturbance
  – Hypercontracting or Hypocontracting esophagus
Evaluation of the Esophagus

- Barium swallow (with barium tablet)
- Timed barium swallow (achalasia protocol)
- Upper endoscopy
- **Esophageal manometry**
- Ambulatory pH monitoring
  - Bravo and transnasal
- Esophageal provocation testing
  - Acid, tensilon, balloon distension
- Esophageal impedance
Clinical Utility of Esophageal Manometry

1. To accurately define esophageal motor function
2. To define abnormal motor function
3. To delineate a treatment plan based on motor abnormalities

Indications for Esophageal Manometry

- Diagnose achalasia
- Suspect impaired esophageal motility
- Dysphagia of unclear etiology
- Pre-op evaluation for fundoplication
- Post-fundoplication evaluation
- Suspect diffuse UGI dysmotility
Esophageal Manometry Methods

- Water perfusion manometry
- Solid state manometry
  - Standard (every 5 cm)
  - High resolution (every 1 cm)
Esophageal Manometry: LES Station Pull-Through

Deep inspiration

Pressure
- LES resting pressure
- LES relaxation
- Proximal margin of LES

(RIP) respiratory inversion point
Esophageal Manometry:
Esophageal Body Measurements

3 cm
• Mean distal esophageal P
• % peristalsis
## Normal Esophageal Manometry

<table>
<thead>
<tr>
<th>Pressure</th>
<th>mmHg (SD)</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>LES</td>
<td>15.2 (10.1)</td>
<td>15 - 45</td>
</tr>
<tr>
<td>Mean distal P</td>
<td>99 (40)</td>
<td>40 – 180</td>
</tr>
<tr>
<td>% of peristalsis</td>
<td>----</td>
<td>&gt; 60%</td>
</tr>
</tbody>
</table>

High-Resolution Esophageal Manometry

Each sensor has 12 pressure sensitive segments that add to the signal at that location.
Normal Peristalsis and Sphincter Relaxation
Classifications of Esophageal Motility Disorders

**Hypercontracting esophagus**  (Esophageal spastic disorders)
- Diffuse esophageal spasm
- “Nutcracker”
- Hypertensive LES

**Hypocontracting esophagus**
- Primary achalasia
- Secondary achalasia or impaired esophageal motility
  - Connective tissue diseases
    - Systemic sclerosis
    - Mixed connective tissue disease
    - Idiopathic inflammatory myopathy
  - Endocrine diseases
    - Diabetes
  - Neuromuscular diseases
    - Chagas disease
    - Amyloidosis
  - Paraneoplastic syndrome
Results of Esophageal Manometry at UofL

Lower esophageal sphincter

- Hypertensive LES: 4%
- Hypotensive LES: 44%
- Normotensive LES: 52%

Esophageal body

- Impaired peristalsis: 22%
- Normal peristalsis
- Nutcracker: 2%

Kindig at el. Presented at DDW 2007 (n=2,796 manometries, achalasia excluded).
Scatter Plots Comparing Esophagus Body and LES

Kindig at el. Presented at DDW 2007 (n=2,796 manometries, achalasia excluded).
Hypercontracting Esophagus
(Esophageal Spastic Disorders)
Hypercontracting Esophagus

- Diffuse esophageal spasm
- Hypertensive LES
- Hypertensive esophagus ("Nutcracker")
Diffuse Esophageal Spasm

>20 % simultaneous contraction
Hypertensive LES

LESP >45 mmHg
Hypertensive Esophagus
(“Nutcracker” Esophagus)

- Esophageal body P > 180 mmHg
- Normal peristalsis
Overlap is Uncommon between Hypertensive LES and Hypercontracting Esophageal Body (“Nutcracker”) (Kindig et al. Presented at DDW 2007 (n=132 patients with hypercontracting esophagus)).
Underlying Causes of Esophageal Spastic Disorders

- GERD
- Esophageal obstruction
  - Stricture
  - Fundoplication
  - Food impaction
- Distension
  - Aerophagia
- Mucosal injury
  - Esophagitis
  - Bravo probe
- Idiopathic
- Secondary esophageal motility disorders
  - Diabetes
  - Pseudoobstruction
  - Amyloidosis
  - Paraneoplastic
Manifestation of Hypercontracting Esophagus

- Noncardiac chest pain
- Intermittent dysphagia
- Heartburn & regurgitation
Non-Cardiac Chest Pain

- Difficult to differentiate non-cardiac from cardiac chest pain.
- Patients may present with squeezing chest pain radiating to the back, left shoulder or jaw, mimicking myocardial ischemia.
- Chest pain can interrupt daily activity and increase work absenteeism.¹

Brain-Gut Axis for Esophageal Chest Pain

Esophageal Origin for Noncardiac Chest Pain

- Acid/Bile
- Obstruction
- Distension
- Temperature of bolus
- Mucosal injury

CNS (Chest Pain)

Sensory Component

Effector Component

Esophagus (Esophageal Spasm)

Abnormal sensation
Psychological factors
Esophageal Spastic Disorders

• Lack of neuromuscular pathology
  – No loss of ganglion cells
  – Inconsistent changes by EM
  – No correlation with disease severity
Evaluation of Non-Cardiac Chest Pain

• Look for underlying cause
• Diagnostic testing
  – PPI test
  – Esophageal manometry
  – Upper endoscopy
  – Ambulatory pH monitoring
  – Ambulatory pH/impedance monitoring
Upper Endoscopy in Non-Cardiac Chest Pain

• Erosive esophagitis and Barrett’s esophagus are found in only 10-25% of patients with non-cardiac chest pain. ¹

• Given its low yield, upper endoscopy is not recommended as part of the initial workup.

PPI Test for Non-Cardiac Chest Pain

- Sensitivity 78%
- Specificity 86%

Omeprazole 40 mg in the morning and 20 mg at night.

PPI Test for Non-Cardiac Chest Pain

• Computer decision analysis models find that starting with the PPI test reduces the need for diagnostic procedures by 43% - 59%. 1-2

• Diagnostic testing should be reserved for non-responders to empiric PPI therapy.

Results of Ambulatory pH Testing in Patients With Non-Cardiac Chest Pain

104 patients

48% Normal pH test
52% Abnormal pH test

Esophageal Motility Abnormalities in Patients with Non-Cardiac Chest Pain

Esophageal Spastic Disorder is Intermittent

- Normal (12%)
- Nutcracker (38%)
- Other motility pattern (50%)

Achem et al. Am J Gastroenterol 1993;847-851
Smooth Muscle Relaxant is Ineffective for Esophageal Spastic Disorders

<table>
<thead>
<tr>
<th>Study*</th>
<th>Therapy</th>
<th>Motility</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattau '91 (n=14)</td>
<td>Diltiazem</td>
<td>↓ Pressures</td>
<td>Improved</td>
</tr>
<tr>
<td>Drenth '90 (n=8)</td>
<td>Diltiazem</td>
<td></td>
<td>No benefit</td>
</tr>
<tr>
<td>Richter '87 (n=20)</td>
<td>Nifedipine</td>
<td>↓ Pressures</td>
<td>No benefit</td>
</tr>
<tr>
<td>Davies '87 (n=8)</td>
<td>Nifedipine</td>
<td></td>
<td>No benefit</td>
</tr>
<tr>
<td>Nasarallah '85 (n=20)</td>
<td>Nifedipine</td>
<td>No benefit</td>
<td>Benefit</td>
</tr>
<tr>
<td>Davies '82 (n=10)</td>
<td>Nifedipine</td>
<td></td>
<td>No benefit</td>
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</tbody>
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*Placebo-controlled cross-over studies
Esophageal Motility Abnormalities are Mostly Non-Specific Phenomena from External Stimuli

- Stress can alter esophageal pressures. ¹
- Many patients with hypercontracting esophagus have GERD. ²
- Look for secondary causes

PPI Treatment for Non-Cardiac Chest Pain

Individual pain score

Overall symptom improvement

- Omeprazole 20 mg bid (n=17) x 8 wks
- Placebo (n=19)

Patients with chest pain and +pH test
PPI Treatment for Non-Cardiac Chest Pain

• Empiric treatment with a twice daily PPI for 2 to 3 months is a reasonable approach.
• PPI may also be effective in patients with hypercontracting dysmotility associated with GERD.  

Difficult Cases
A Patient with Intermittent Dysphagia
A Patient with Intermittent Dysphagia (Cont.)
A Patient with Hypertensive LES
Hypocontracting Esophagus: Aperistalsis and Impaired Esophageal Peristalsis
Esophageal Aperistalsis

- Primary aperistalsis (achalasia)
- Secondary aperistalsis
  - Connective tissue diseases
  - Chagas disease
  - Paraneoplastic syndrome
  - Post-fundoplication
  - Vagal trauma
  - Severe GERD
A. NORMAL PATIENT

pre-ganglionic vagal fiber

post-ganglionic fiber

CCK-OP

LES muscle

B. ACHALASIA PATIENT

CCK-OP

LES muscle

Primary Achalasia

• Decrease # of inhibiting neurons in the LES
• Patients can be young or old
• Etiology is still unclear
  – Inflammatory response and infection likely
• Chronic progression of symptoms
• Presentation can be subtle in early achalasia
Symptoms of Achalasia Can be Diverse

- Chronic dysphagia to liquids and solids
- Nocturnal regurgitation
- Chest pain
- Heartburn
- Weight loss
- Aspiration/choking
Achalasia
Timed Barium Esophagram

Swallow 100-250cc of 45% barium over 30-45 seconds. Take pictures at 1, 2 and 5 minutes.
- Elevated LES pressure
- Poor LES relaxation
• Absent esophageal peristalsis (required to diagnose achalasia)
Achalasia
Treatment Should be Individualized in Primary Achalasia

- Nitrates and calcium channel blockers
  - Benefit is short term
- Endoscopic botox injection
  - Symptoms always recur
  - Useful for elderly patients or poor surgical candidates
- Endoscopic pneumatic dilation
- Laparoscopic Heller myotomy
Achalasia: Pneumatic Balloon Dilation
Achalasia:
Pneumatic Balloon Dilation

Obliterate the “waist” created by the LES
Pneumatic Dilation in Achalasia

- Goal: rupture the LES
  - Gastrograffin & barium swallow after dilation
- Success
  - 65-80%
- Perforation
  - 2 to 15% (depends on balloon size)
Impaired Esophageal Peristalsis

Mean distal peristaltic P < 30 mmHg
or
Peristaltic waves < 60%

Underlying Causes of Secondary Achalasia and Hypocontracting Esophagus

- GERD
- Connective tissue diseases
  - Systemic sclerosis
  - Mixed connective tissue disease
  - Idiopathic inflammatory myopathy, lupus, Sjogren’s
- Endocrine diseases
  - Diabetes
- Neuromuscular diseases
  - Chagas disease
  - Amyloidosis
  - Paraneoplastic syndrome
  - Autonomic neuropathy
Systemic Sclerosis

• Early stage
  – Neural dysfunction, ?Vascular insufficiency
  – Esophagus response to edrophonium
• Late stage
  – Neural and muscular dysfunction
  – Smooth muscle fibrosis
  – Poor response to methacholine
• Acid reflux is associated with impaired esophageal motility
Systemic Sclerosis
Paraneoplastic GI Motility Syndrome: Anti-Hu Antibody* Against Enteric Neurons

*Antinuclear neuronal antibodies (ANNA)
Paraneoplastic GI Motility Syndrome

- Cancer antigens mimicking neuronal tissues.
- Myenteric plexus infiltrated by lymphocytes and plasma cells.
- Cancers
  - Small cell lung cancer (80%), breast, ovarian, multiple myeloma, Hodgkin’s lymphoma.
- GI symptoms can precede diagnosis of cancer.
Summary: Esophageal Motility Disorders

• Hyper vs. Hypocontracting esophagus
• Hypercontracting (esophageal spastic) disorders represent a dysfunction rather than the cause
• Look for underlying cause
  – GERD, systemic diseases, diffuse motility disorder, paraneoplastic, etc.