

Utilizing the Functional Lumen Imaging Probe in Practice

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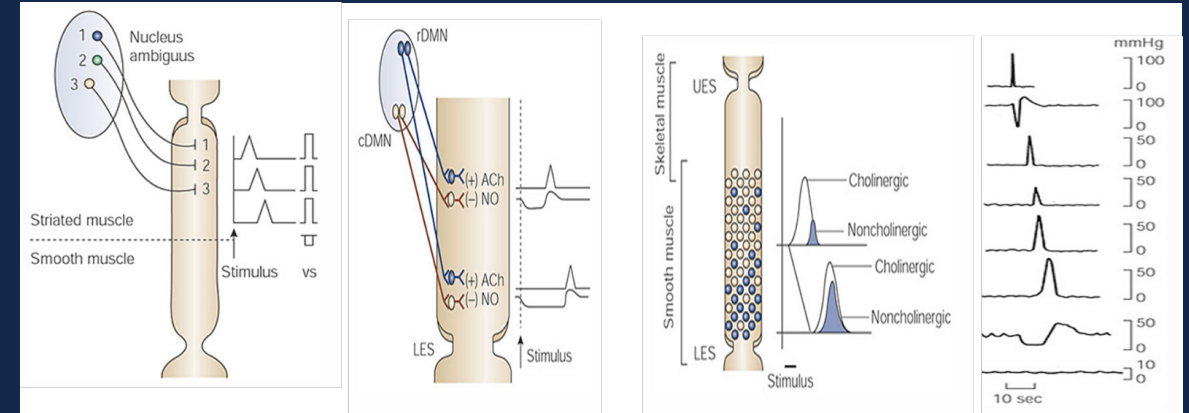
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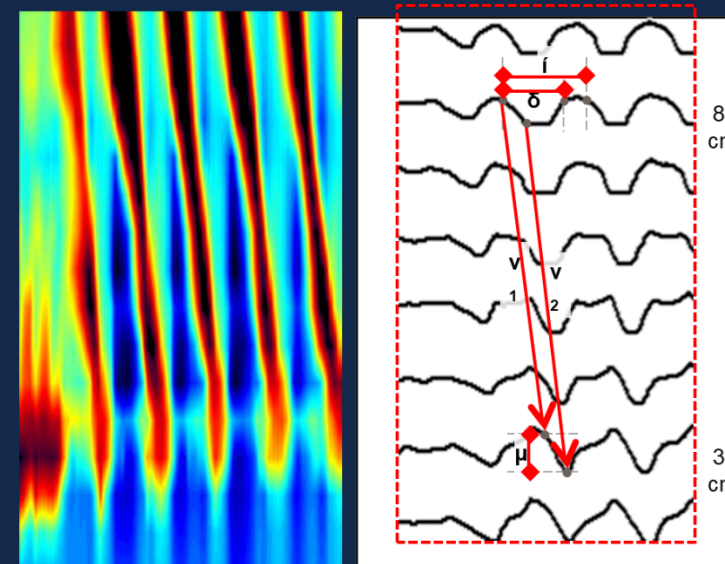
Fundamental Principles of Esophageal Peristalsis

Primary Peristalsis: Deglutition initiates relaxation of the lower esophageal sphincter and a coordinated peristalsis

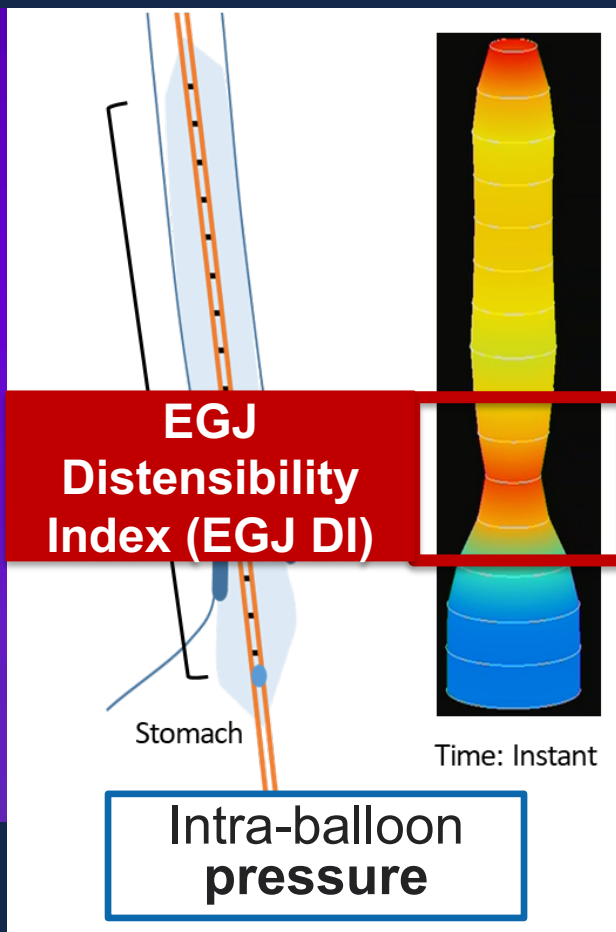
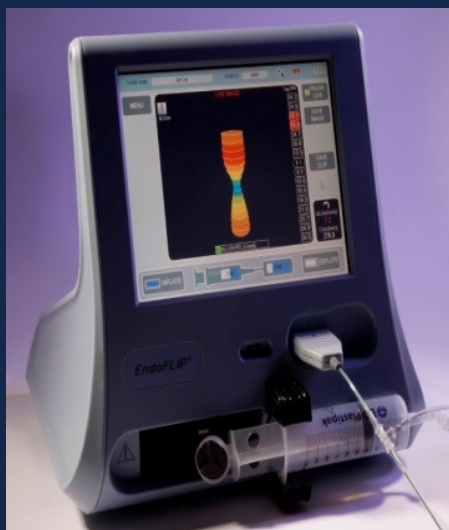


Secondary Peristalsis: Peristaltic response to distension from refluxate/retained contents

Functional lumen imaging probe (FLIP) distention provides a sustained volumetric distention and a mechanism to assess the response to this stimulus.



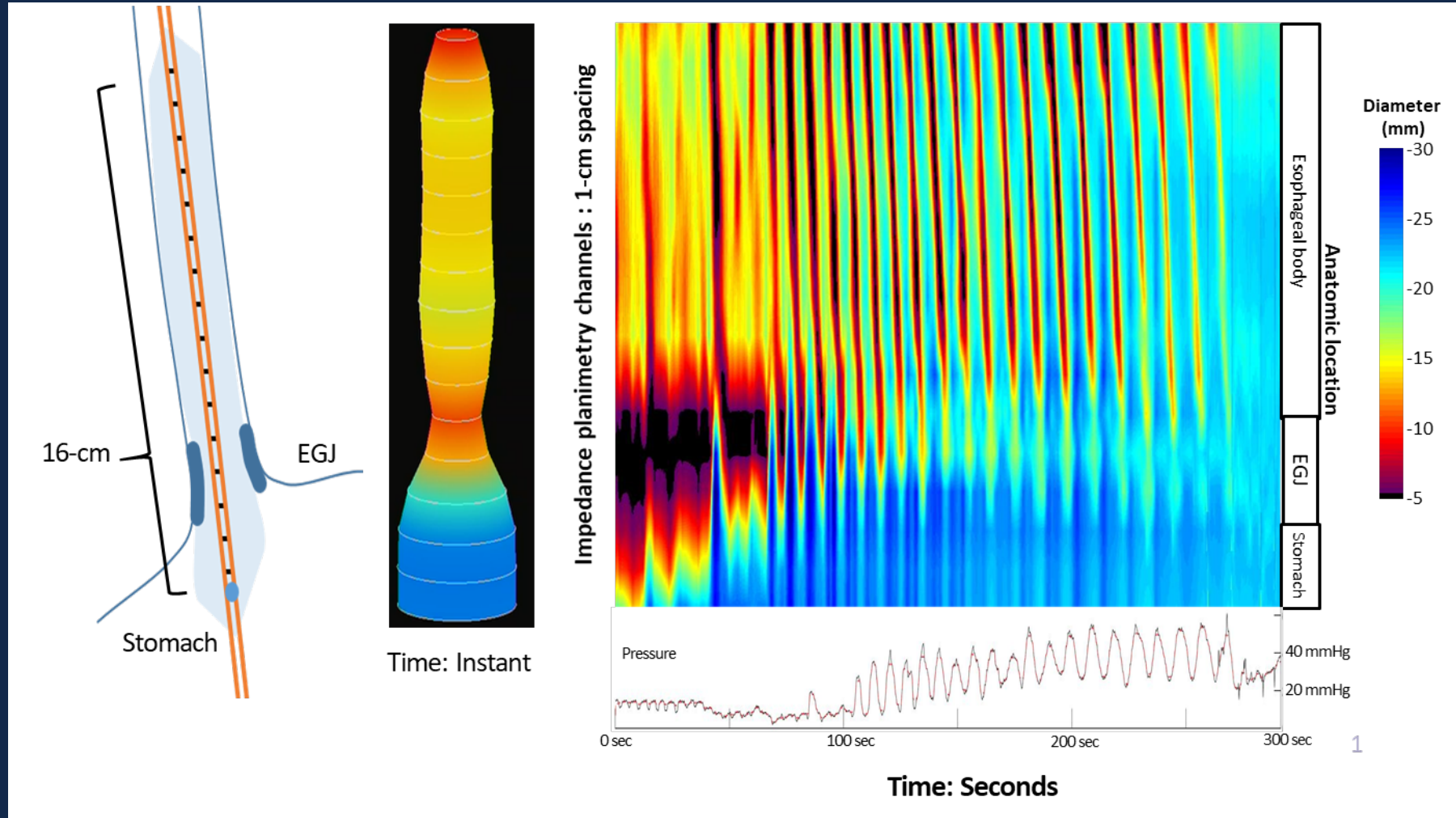
Functional Luminal Imaging Probe (FLIP)



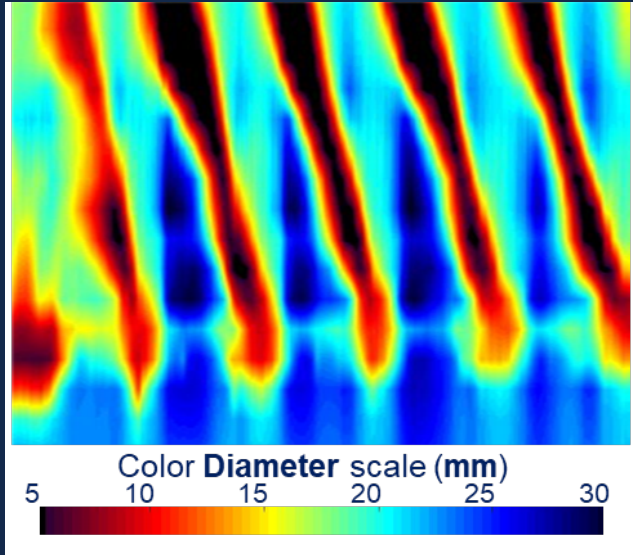
Impedance planimetry measures 16 luminal diameters (mm)

DISTENSIBILITY:
Relationship between luminal geometry (CSA) and distensive pressure

FLIP with Topography: FLIP Panometry



FLIP *Patterns* of Contractile Response to Distension



Functional Luminal Imaging Probe

- Repetitive ANTEGRADE contractions (RACs)
- Intact EGJ Distensibility

Normal Esophageal Response to Distension

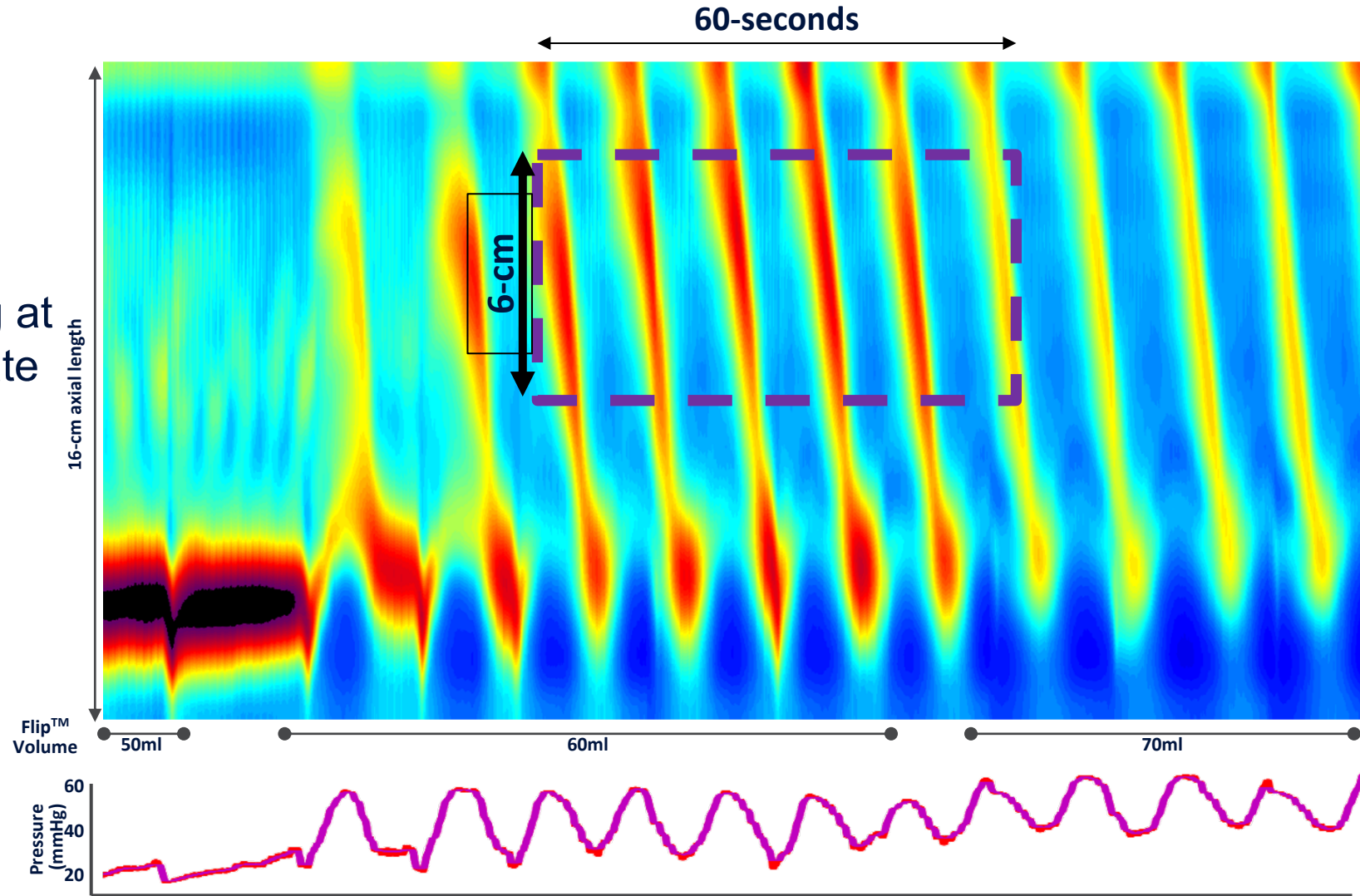
Repetitive antegrade contractions (RACs)

- **RAC-Rule of 6s©**

- ≥ 6 consecutive AC's of
- ≥ 6 cm in axial length occurring at
- 6 ± 3 AC per minute regular rate

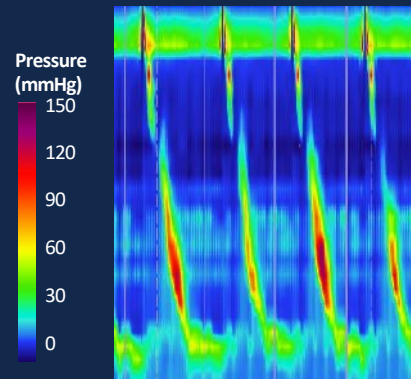
RAC Ro6s©

- 19/20 asymptomatic controls
- 0/140 achalasia patients

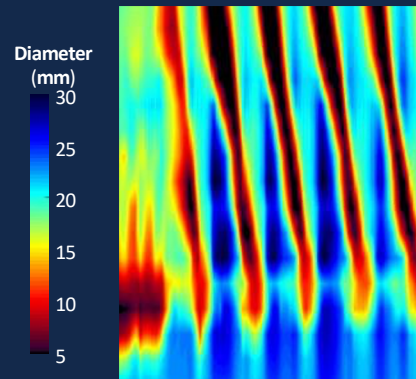


FLIP Panometry: Contractile Patterns

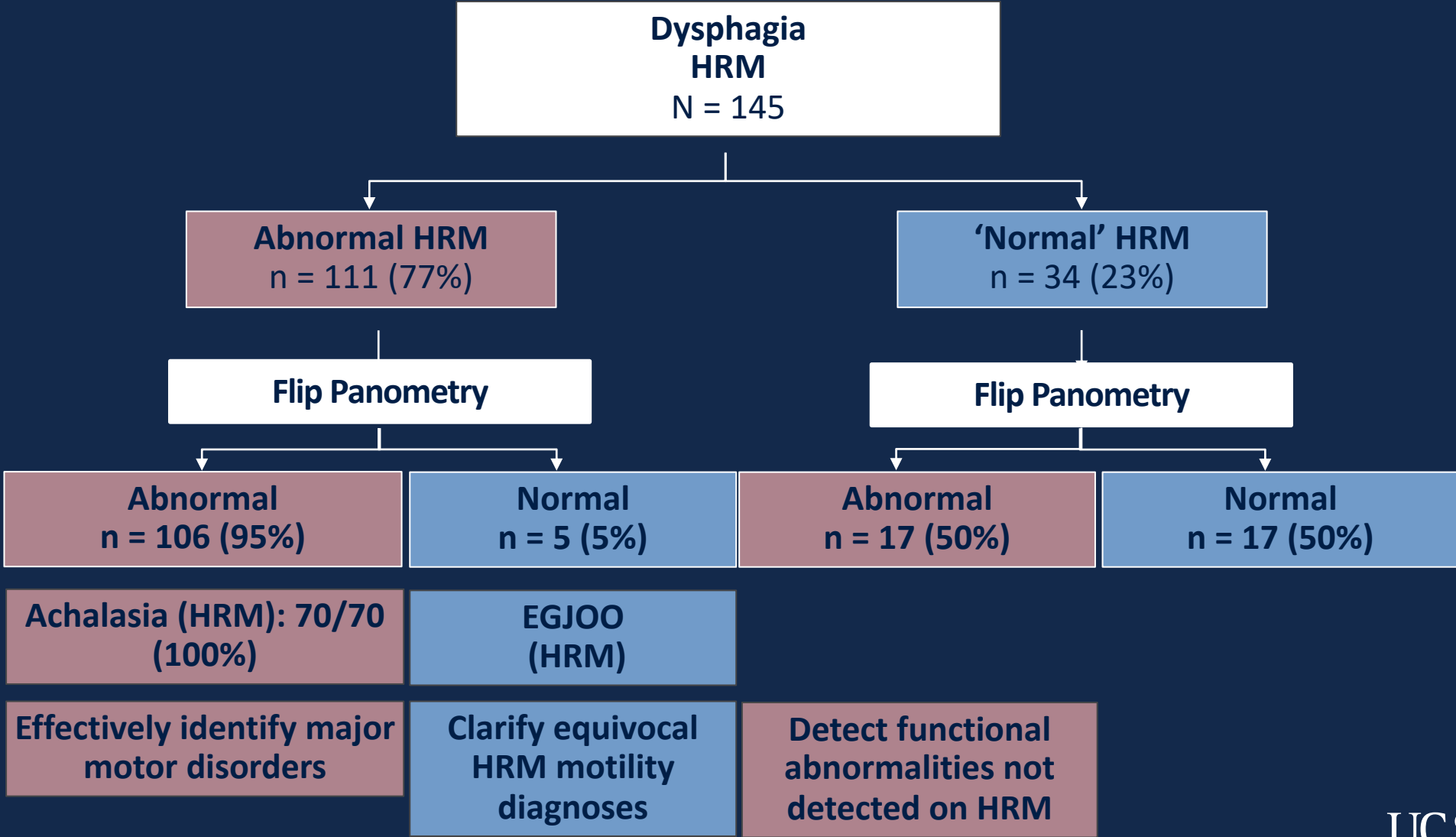
Normal Peristalsis with
Normal EGJ relaxation



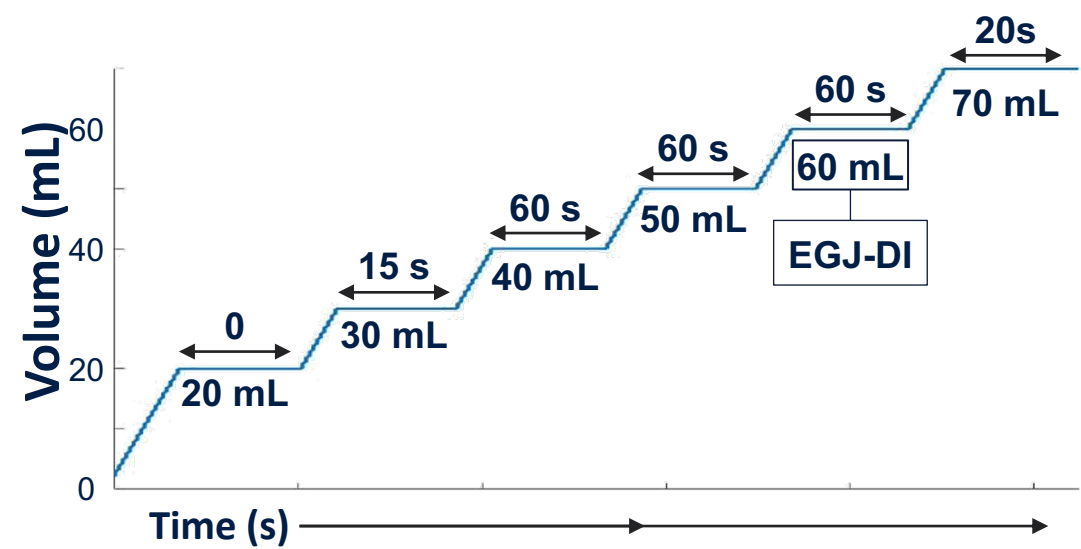
RACS with normal EGJ-DI



Relationship of HRM and FLIP Panometry



EF-322 Protocol:



Courtesy of the Esophageal Center at Northwestern

| Catheter | EF-322 |
|--|---------------------------|
| Size | 16 cm |
| Impedance Sensors | 16 spaced 1cm apart |
| Balloon Fill Protocol | Fill to 40, 50, 60, 70 mL |
| Measurements at <u>each fill level</u> | |
| <ul style="list-style-type: none">•EGJ-DI**•EGJ-Diameter**•Intra-bag pressure**•Presence of any contractility•Presence of RACs•Presence of RRCs | |

**Measured when the narrowest luminal diameter achieves maximal diameter

Metrics on FLIP Technology to Guide Clinical Diagnosis

| | | | |
|--|--|---------------------|---------------------------------|
| | EGJ Distensibility Index (EGJ-DI) | EGJ-Diameter | Contractile Response |
|--|--|---------------------|---------------------------------|

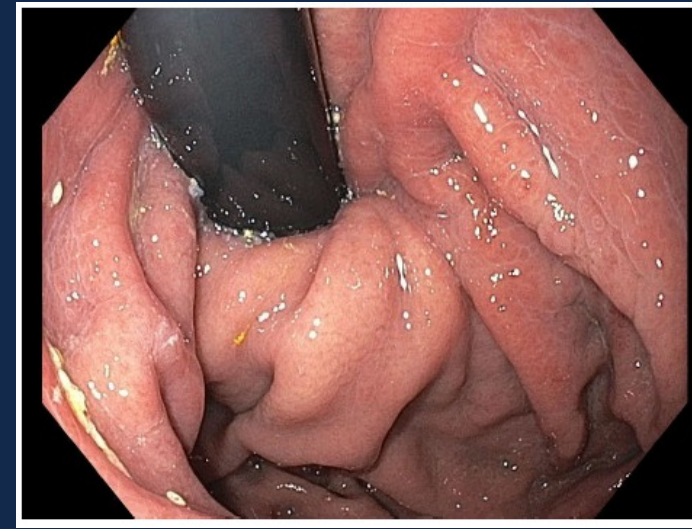
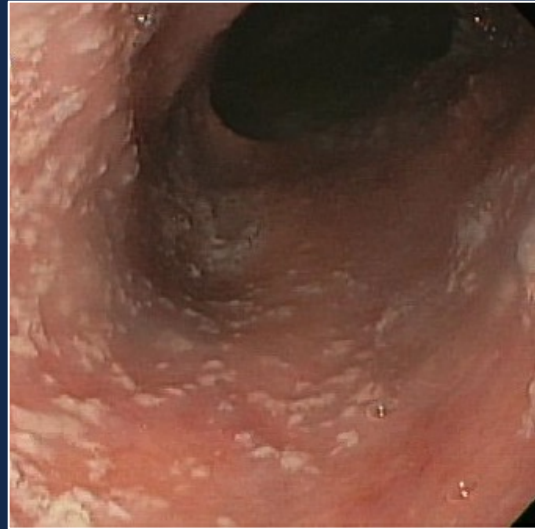
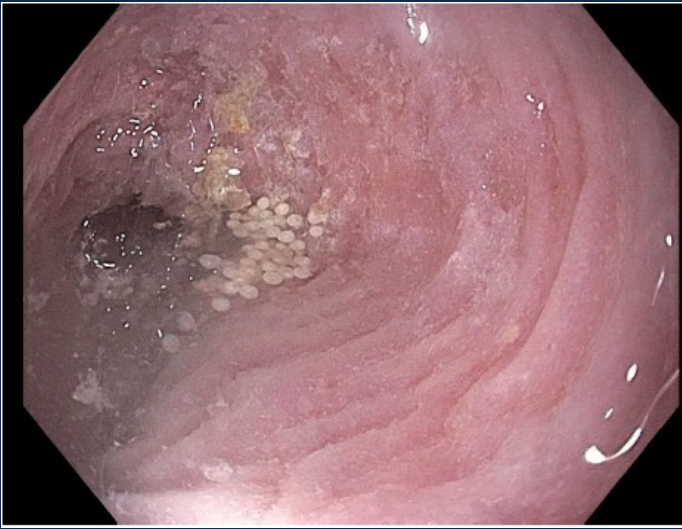
*Especially in the setting of normal endoscopy and biopsy

Case 1: 65 yo woman with dysphagia x 2 years

- Progressive dysphagia to solids > liquids, now with 75% of intake
- Regurgitation, cough, throat burning, retrosternal chest pain, mild heartburn
- PPI helped heartburn but did not impact dysphagia or regurgitation

Broad differential: Concerned about a major motility disorder, erosive esophagitis, non-erosive GERD, possibly eosinophilic esophagitis

Case 1: 65 yo woman with dysphagia x 2 years

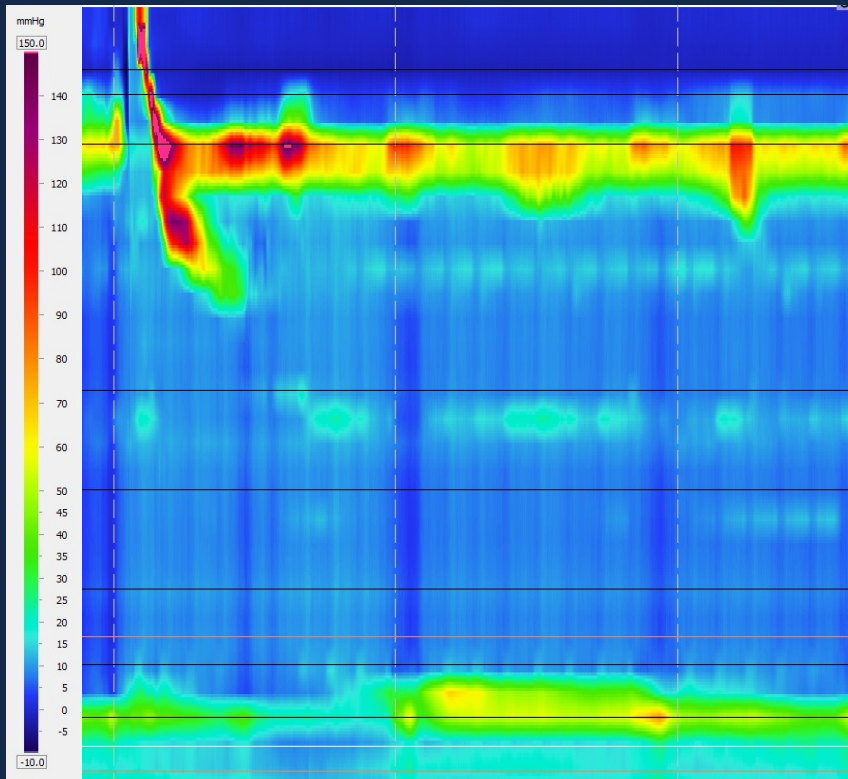


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- Dilated esophagus with small amounts of retained fluid and pills
- White plaques consistent with candida
- No difficulty traversing the LES
- No pericardial mass. Gastroesophageal flap valve I

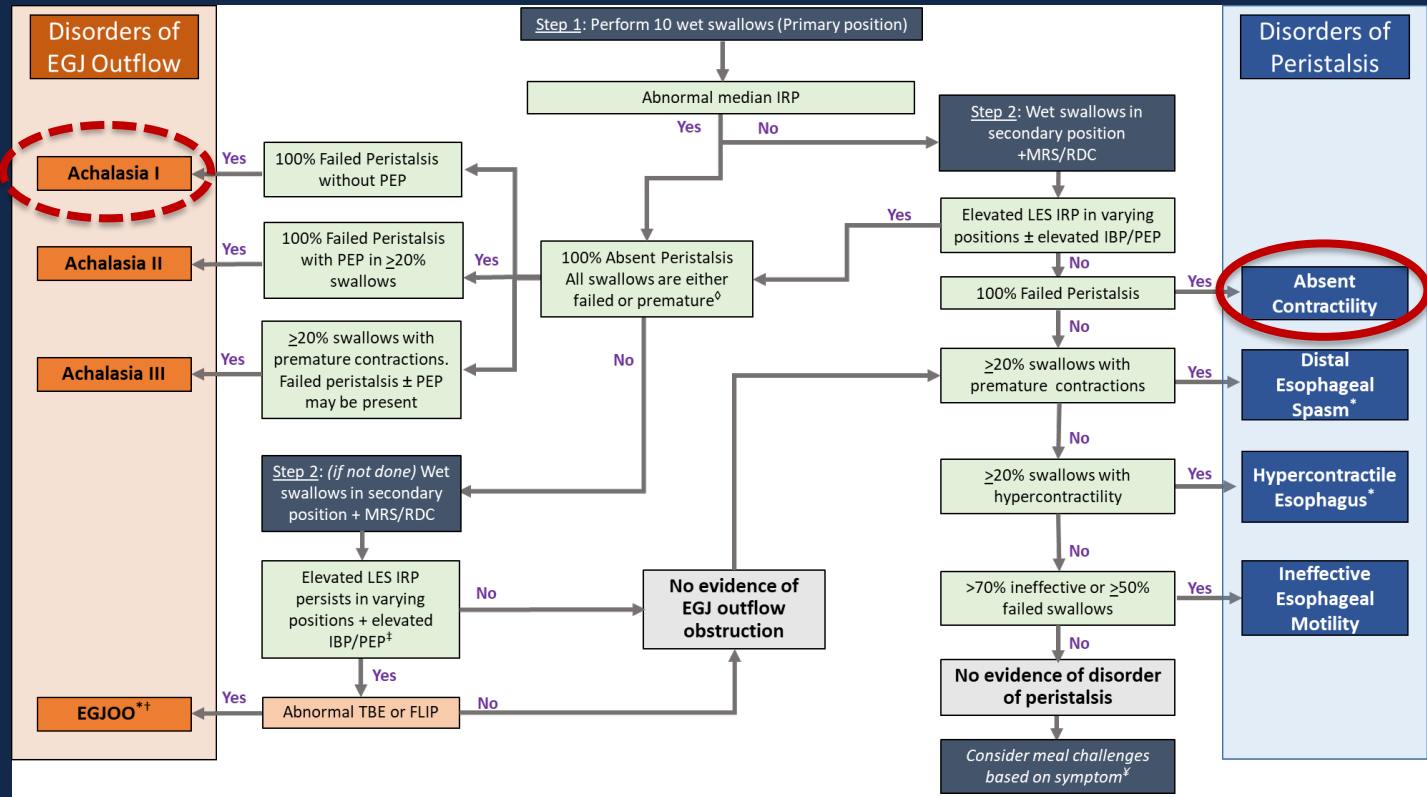
Case 1: 65 yo woman with suspected esophageal motor disorder

High-Resolution Impedance Manometry



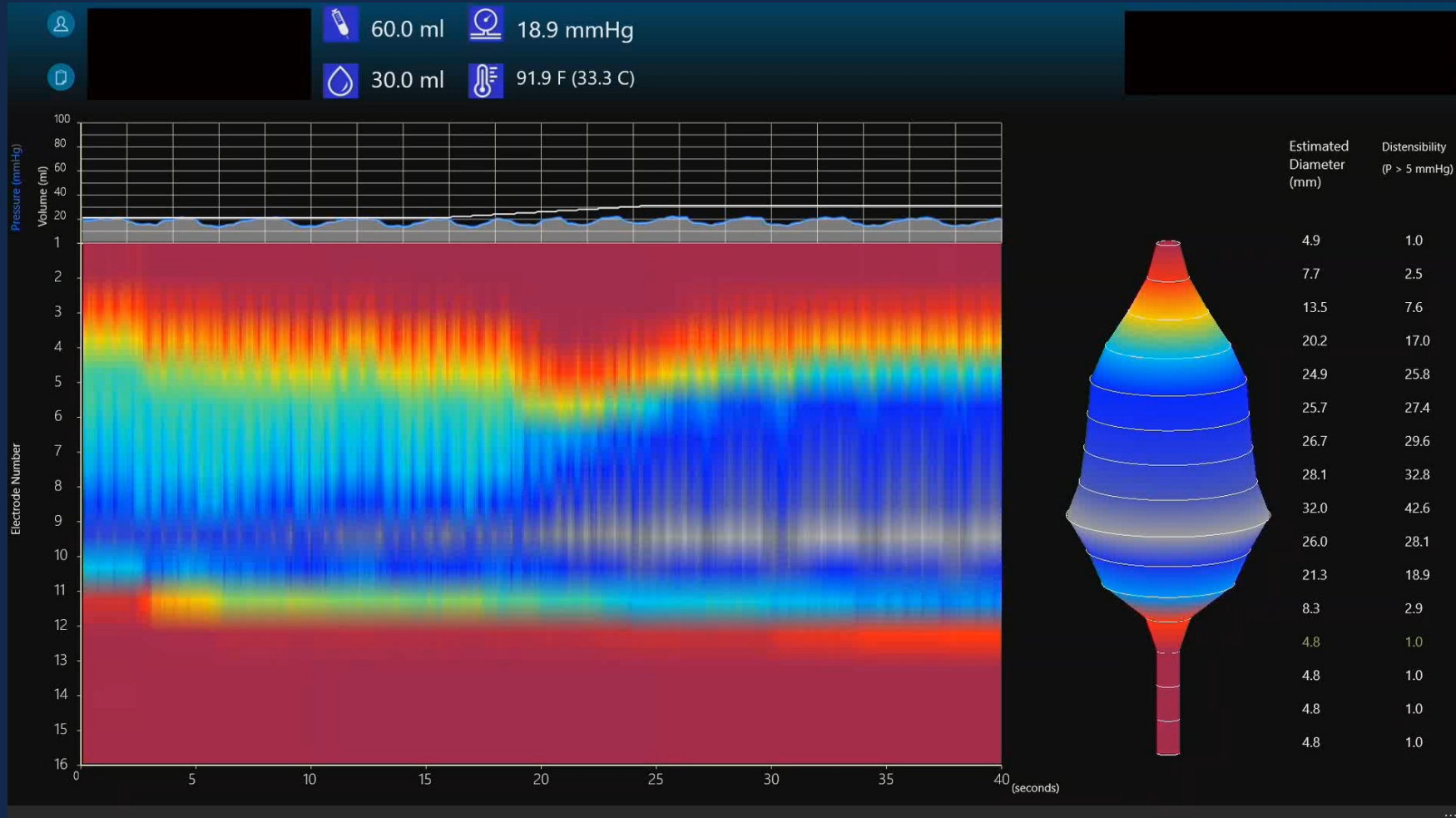
100% failed peristalsis
Median LES IRP 10.5mmHg

Chicago Classification version 4.0



Yadlapati R, et al. *Neurogastroenterol Motil.* 2021

Case 1: 65 yo woman with suspected esophageal motor disorder



Panometry study:
EGJ-DI 1.0 mm²/mmHg
Absent contractile response

EGJOO with absent contractile response

Case 2: 35 yo man with chest pain & belching

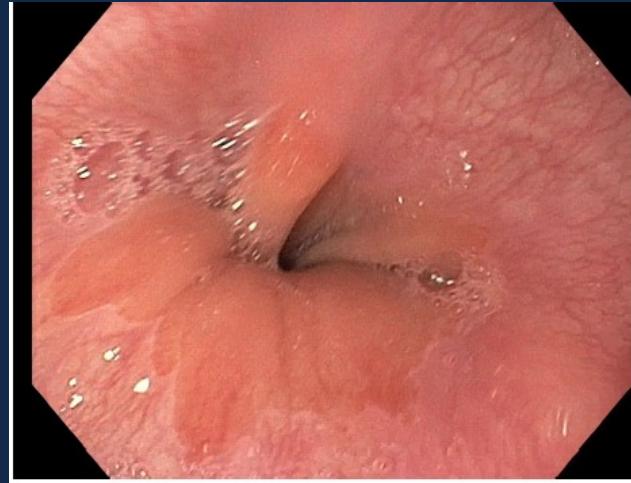
- Chest pain with meals and at bedtime. Non-cardiac
- Mild heartburn, 20-30% improvement with PPI
- Vigorous frequent belching
- Intermittent dysphagia to solids
- History of psoriasis, asthma, allergic rhinitis

Broad differential: GERD, eosinophilic esophagitis, motility disorder, functional disorder

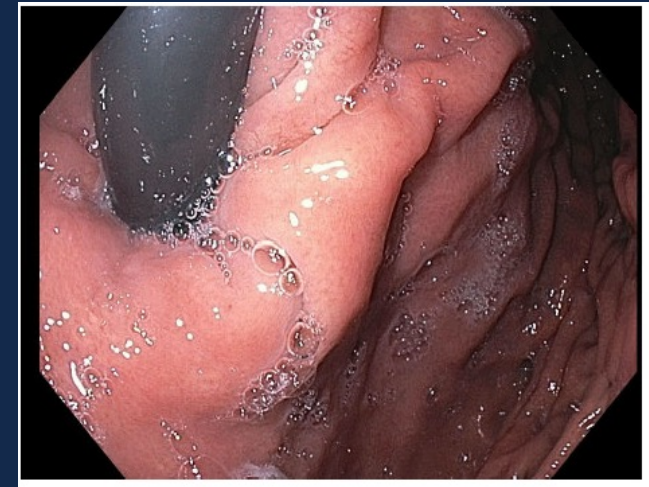
Case 2: 35 yo man with non-cardiac chest pain, mild HB/dysphagia, belching



Normal esophageal mucosa.
No eosinophils on biopsy



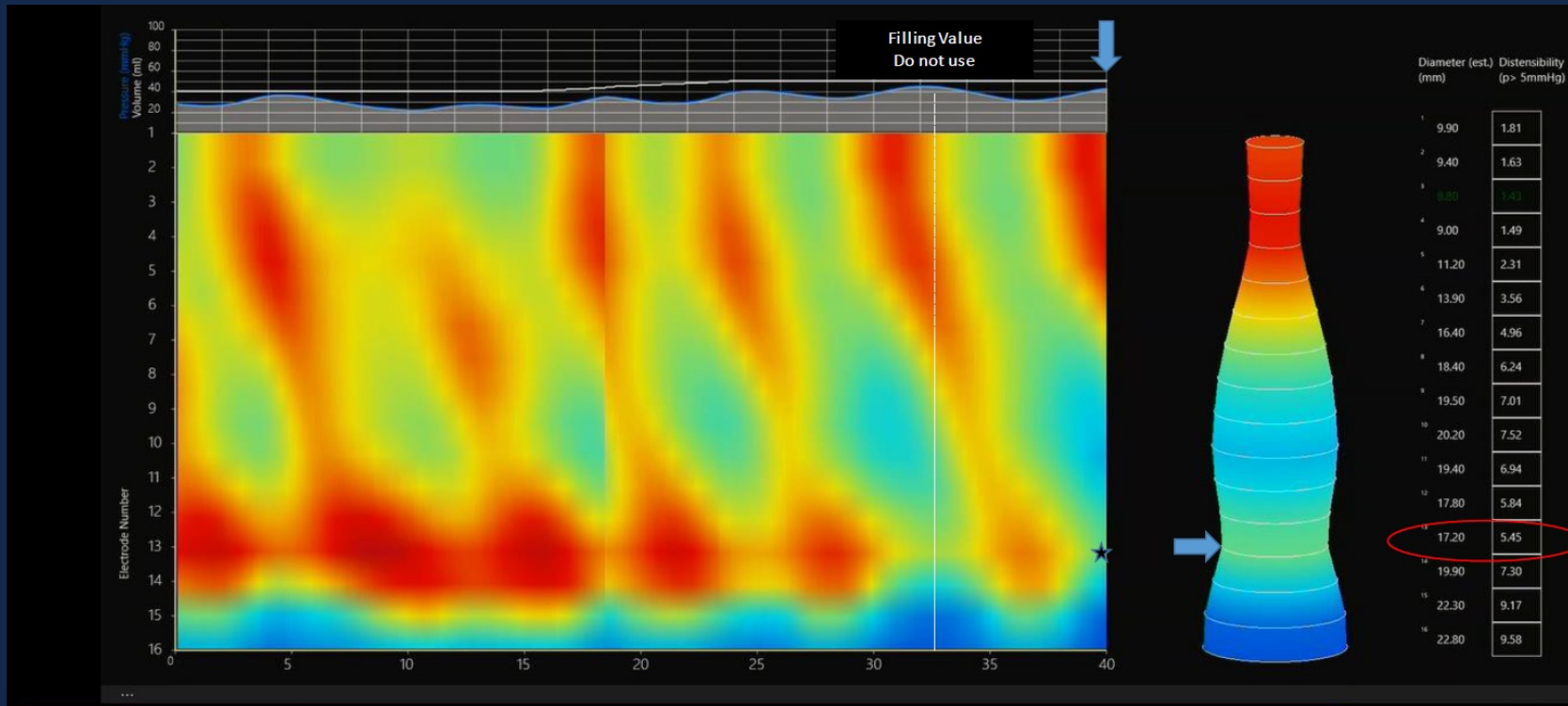
Normal esophago-gastric junction



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Gastroesophageal flap valve I

Case 2: 35 yo man with non-cardiac chest pain, mild HB/dysphagia, belching and normal endoscopy



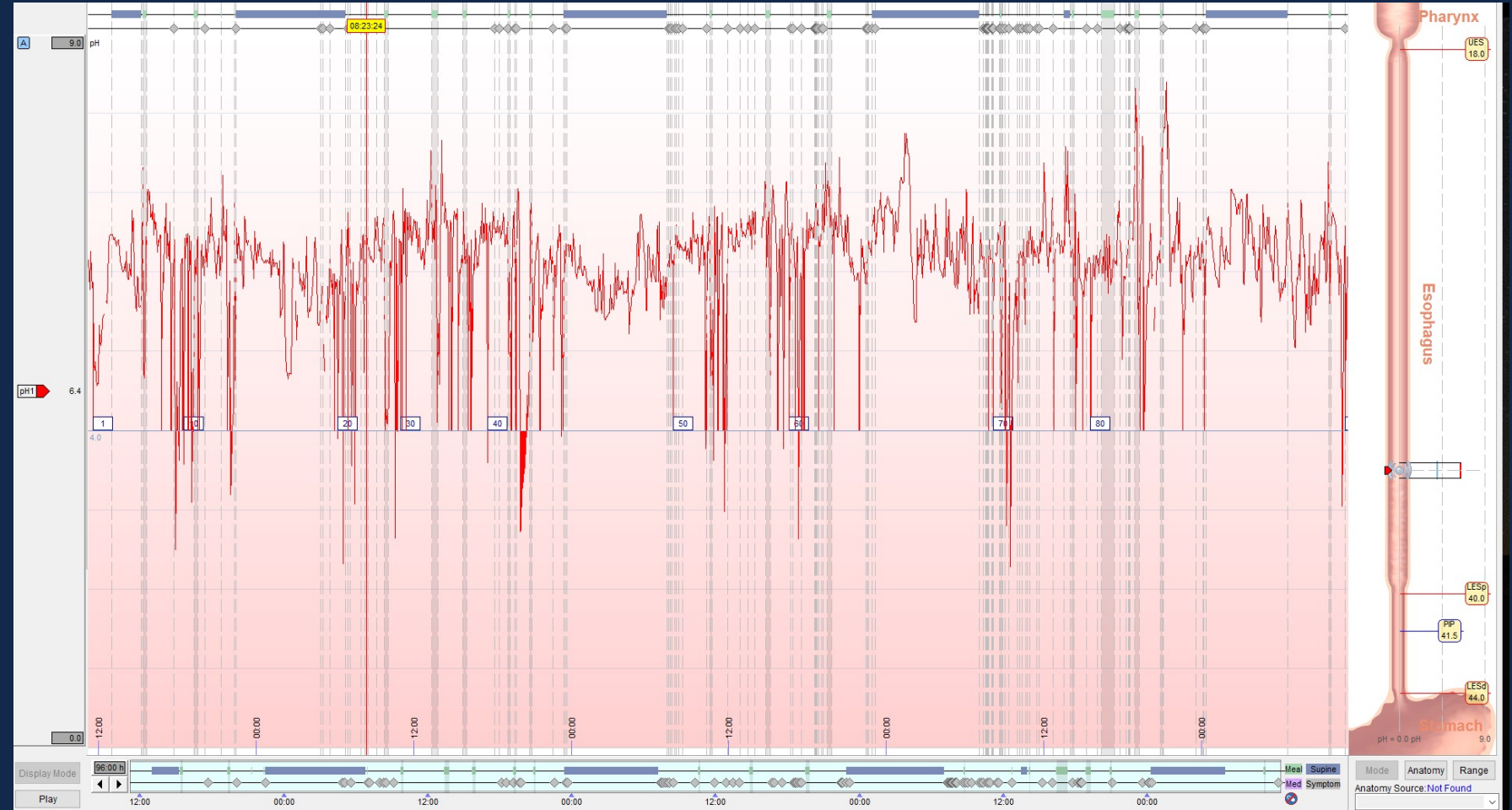
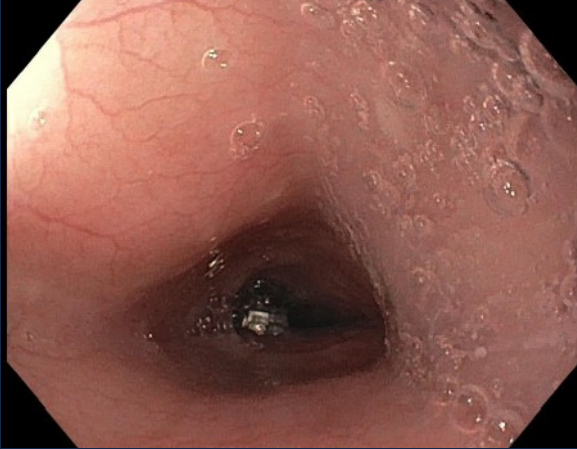
Panometry study:

EGJ-DI 5.4 mm²/mmHg

Repetitive antegrade contractions

Normal EGJ distension and contractile response

Case 2: 35 yo man with non-cardiac chest pain, mild HB/dysphagia, belching, normal endoscopy, normal FLIP

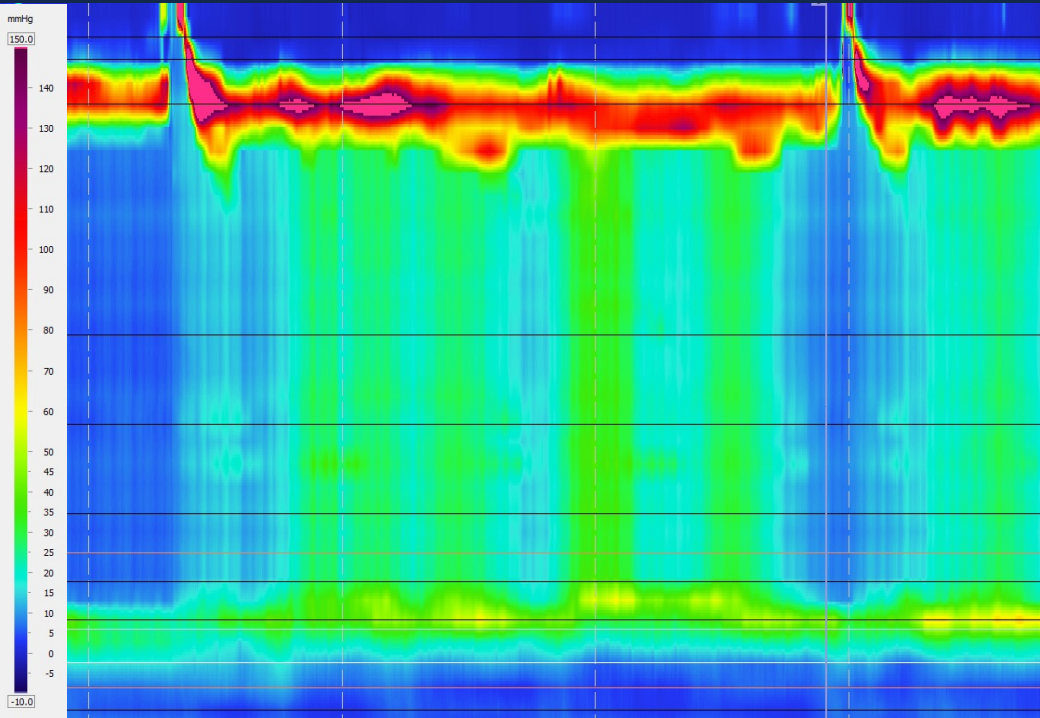


Case 2: 35 yo man with non-cardiac chest pain, mild HB/dysphagia, belching

- One visit: normal endoscopy with no signs of EoE or GERD, and normal FLIP
- Suspect functional esophageal and supragastric belching disorder
 - Counseled on breathing exercises, provided reassurance, did not resume PPI, started low dose TCA, & referred for esophageal directed hypnotherapy
- *Can consider post-prandial high-resolution impedance manometry and impedance-pH to objectively evaluate for supragastric belching in future*

Case 3: 46 yo woman with dysphagia, regurgitation, chest pain, weight loss, and outside endoscopy with dilated esophagus/hypertonic LES

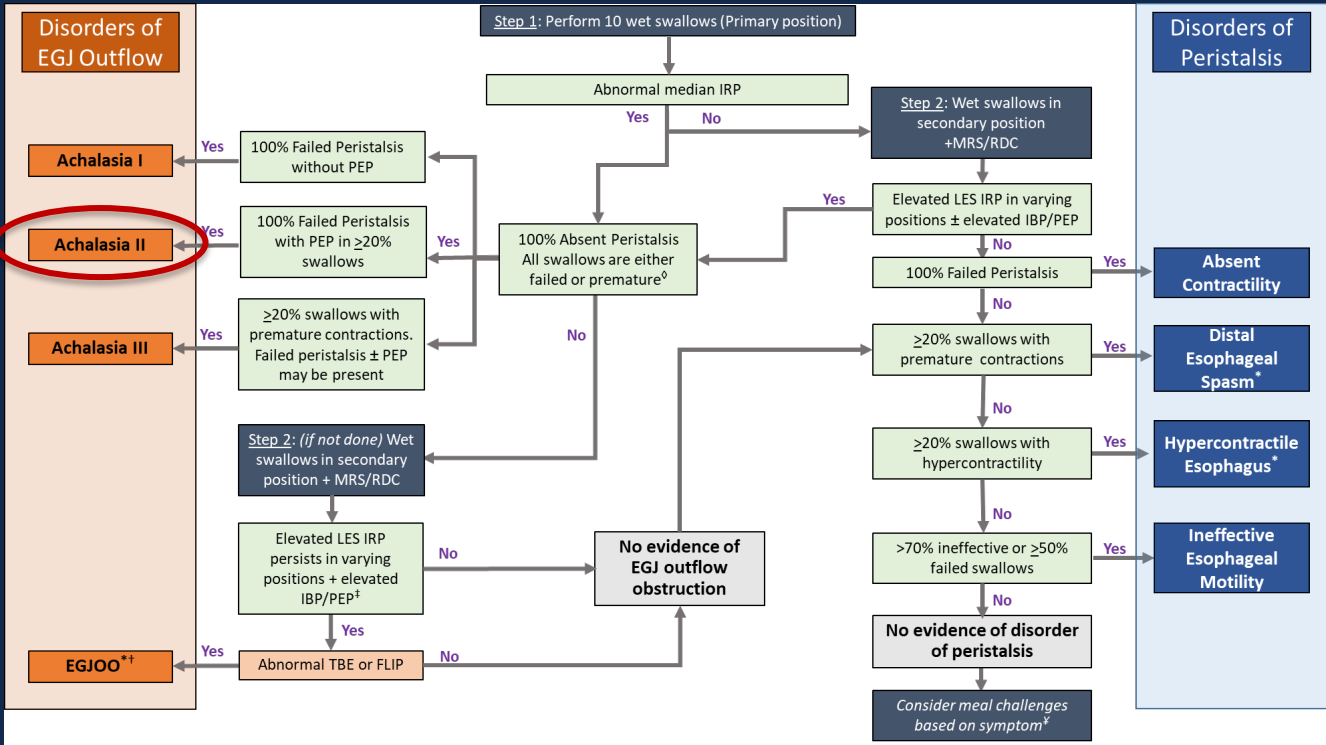
High-Resolution Impedance Manometry



100% failed peristalsis
90% pan-esophageal pressurization
Median LES IRP 24.2mmHg

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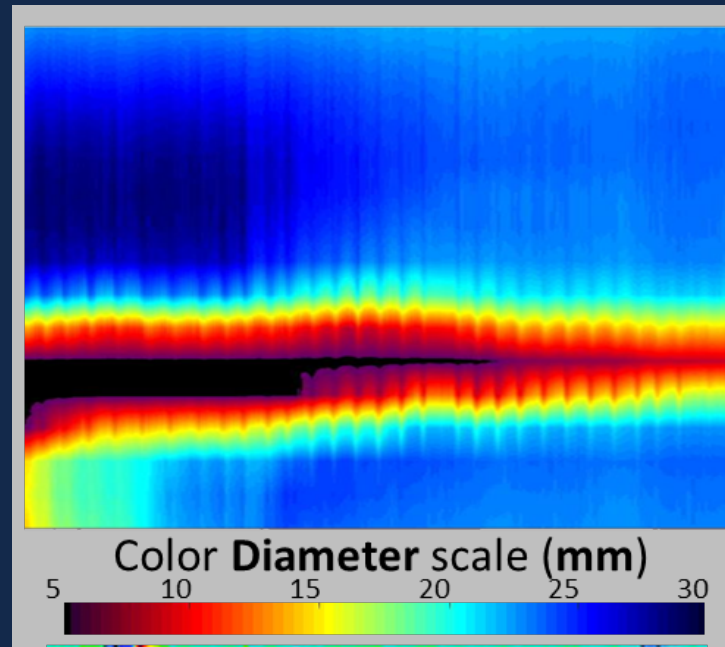
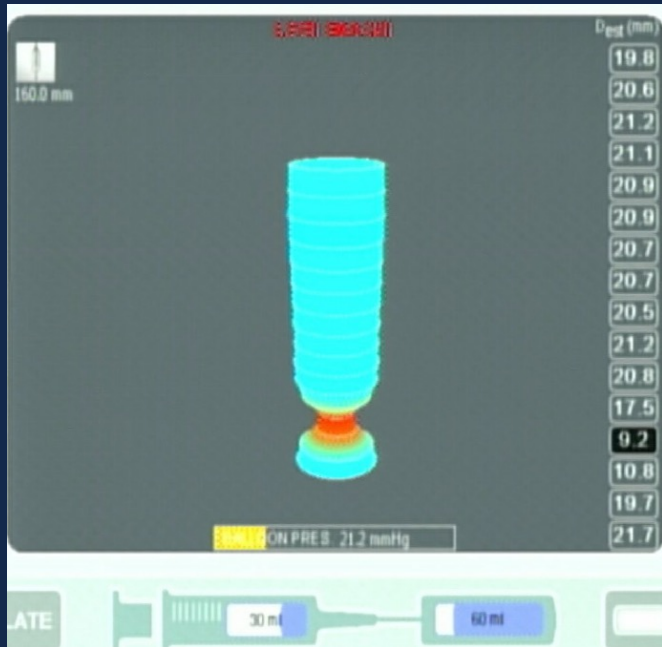
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Case 3: 46 yo Achalasia type II presenting for POEM

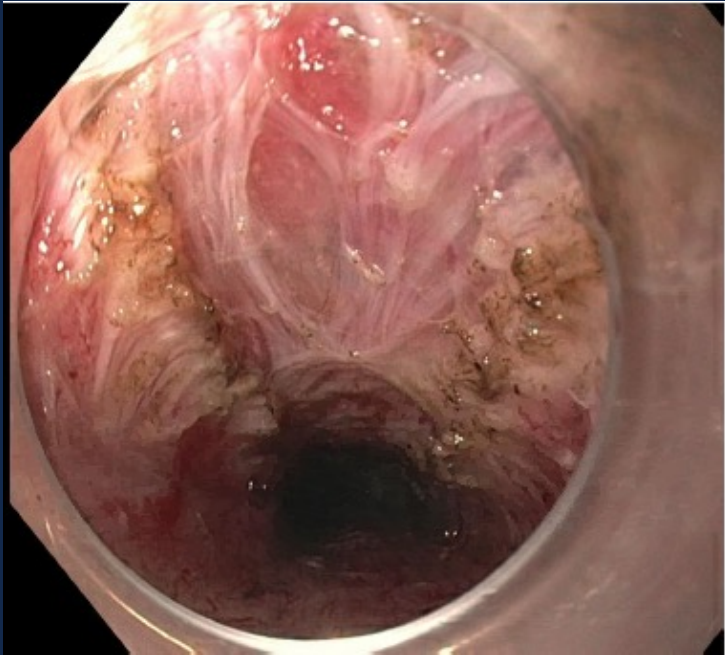
Pre-POEM: FLIP 2.0: EGJ DI 2.4mm²/mmHg, diameter 9.2mm, absent contractile response to distension



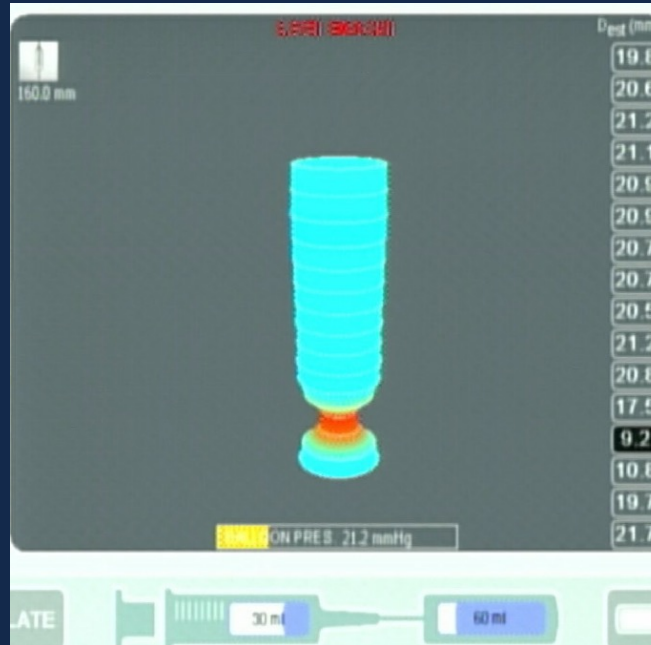
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Case 3: 46 yo Achalasia type II presenting for POEM

POEM procedure performed with
7cm anterior myotomy



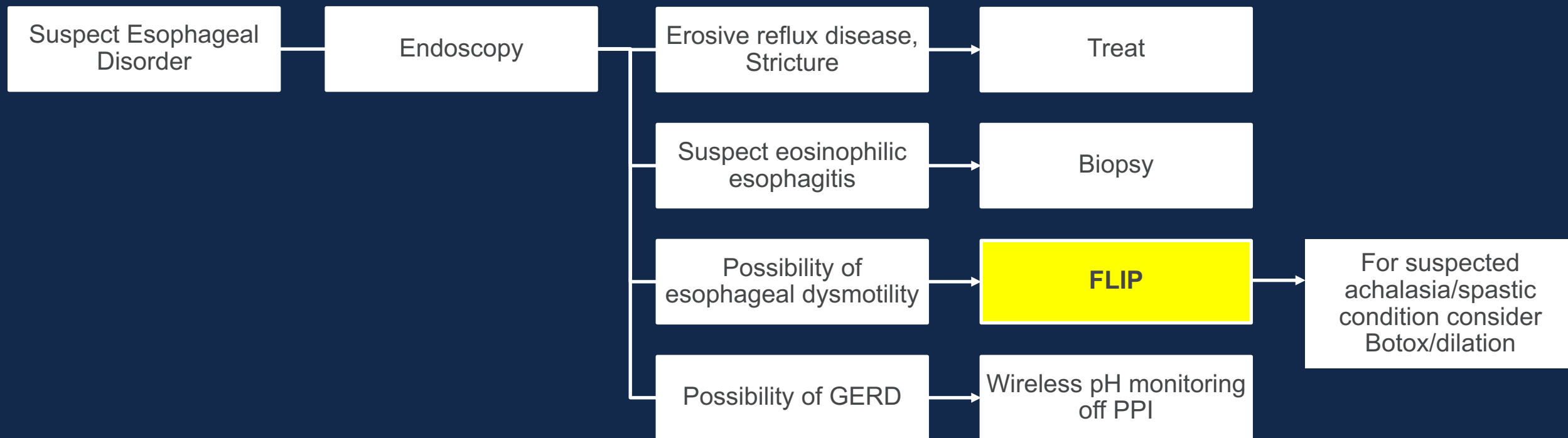
Pre-POEM
EGJ DI 2.4mm²/mmHg



Post-POEM
EGJ DI 5.4 mm²/mmHg



Utilizing FLIP in Clinical Practice



Utilizing FLIP in Clinical Practice

Streamlined Patient Evaluation in One Session:

- Assess for GERD (erosive/non-erosive), Eosinophilic esophagitis, Esophageal dysmotility
- Potential to treat in real-time: Stricture, Spastic esophageal disorder, Achalasia
- If all tests normal → may suggest functional esophageal disorder and streamline care
- Can further assess with high-resolution impedance manometry and barium esophagram as indicated

Supportive Diagnostic Role:

- Assess EGJ distensibility for indeterminate cases on manometry/barium esophagram
- Guides intervention technique such as myotomy or anti-reflux intervention in real-time



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