GI MOTILITY: NEW TECHNOLOGIES

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MOTILITY TESTING: a potpourri of G1 issues

**ESOPHAGUS:**
- GASTROESOPHAGEAL REFLUX DISEASE (GERD)
- DYSPHAGIA

**STOMACH:**
- CYCLICAL VOMITING
- GASTROPARESIS

**SMALL INTESTINE:**
- IRRITABLE BOWEL SYNDROME (IBS)
- MALABSORPTION

**ANORECTAL:**
- CONSTIPATION
- FECAL INCONTINENCE
OBJECTIVES:

• THE GI LAB: Be aware of the expanding variety of GI studies in today’s GI Lab;

• ESOPHAGEAL MANOMETRY: understand some of the new technology and nursing practice trends (related pearls);

• CASE STUDIES: Relate various motility case outcomes – esophageal, gastric and anorectal – to a medical plan of care;
THE GI LAB & TEAMWORK

GI LAB OPERATIONS:
• EQUIPMENT – Computer technology and electronics;
• SUPPLIES – Medication and accessories to equipment;
• THE SUITE – is typically:
  ✓ fully ambulatory and linked to an endoscopy unit;
  ✓ not needing a great deal of space, i.e. 14 x 16 ft;
  ✓ visibly appealing;
• MOTILITY TEAM - may include:
  ✓ specially trained physicians, mid level and nurse/tech
  ✓ clinic support staff and rotating residents/fellows;
THE GI LAB & TEAMWORK

REFERRAL TEAM: i.e. PCP, GI or surgical consults;

RESEARCH TEAM: Examples to follow (slide #19);

ONLINE AND JOURNAL TEAM: helpful learning resources - American Motility Society, GI Motility Online, Gastro.org (AGA), SGNA.org and The DAVE Project;

PRODUCT TEAM: Sandhill Scientific, Sierra Instruments, GIVEN Imaging, EZEM, Quintron, and others ...
EXPANDING TECHNOLOGY: An Overview

STANDARD MOTILITY TESTS IN A GI LAB:

ESOPHAGEAL MANOMETRY –
• Water perfusion pressure system;
• Solid state or air fill pressure system;
• High definition pressure system with impedance;
• (HRM) High Resolution Manometry or “real time” image;

ESOPHAGEAL pH STUDY –
• Nasal catheter 24 hour with external recording device;
• Wireless capsule 48 hour with external recording device;

*represents the minimum tests offered in a smaller GI Lab*
EXPANDING TECHNOLOGY: An Overview

ADDITIONAL TESTS:

ELECTROGASTROGRAM (EGG) –
• Gastric emptying study with a water load test;
• External electrodes, computer software and recorder;

HYDROGEN BREATH TEST – breath sample analyzer;

ANORECTAL MANOMETRY/BIOFEEDBACK –
• Water perfusion pressure system;
• Solid state/air fill pressure system and HRM;
EXPANDING TECHNOLOGY: An Overview

OTHER SPECIALIZED DIAGNOSTIC TESTS:

• Small Bowel Motility Testing
• Esophageal capsule endoscopy
• Small Bowel Capsule Endoscopy
• Other emerging technologies –
  ✓ Smart pill
  ✓ Pelvic floor nerve testing

*Tests offered in addition to standard motility testing generally provided in larger, research centers*
The GI LAB provides useful and definitive testing for the diagnosis and management of:

- Common GI problems, i.e. GERD, chronic constipation or fecal incontinence;
- Less common problems – dysphagia and other motor abnormalities (mouth to anus);
- GI Motility and functional disorders affect 25% of the U.S. population and 40% of people with GI issues who require a referral;
ESOPHAGEAL MOTILITY TESTING

FROM PEAKS & VALLEYS
TO
COLOR CONTOURS WITH DEFINITION
Standard tests often part of the medical history to evaluate esophageal function:

- **Esophageal Manometry** - to study esophageal muscle contraction;

- **Esophageal pH Monitoring** – to measure changes in the acidity of the esophagus, i.e. gastroesophageal reflux disease (GERD);
ESOPHAGEAL MOTILITY TESTING: Standard tests

• X-ray Studies - a fluoroscope is used to follow the progress of a barium mixture during the process of swallowing, or by using a radioactive scanning technique;

• EGD – is usually done prior to the manometry and pH testing;
ESOPHAGEAL MANOMETRY TESTING: Purpose & accepted methods

PURPOSE:

• most useful to evaluate dysphagia, non-cardiac chest pain and prior to anti-reflux surgery;
• helpful to exclude a GI tract condition, i.e. achalasia or scleroderma;

ACCEPTED MANOMETRIC METHODS:

• water perfusion and solid state pressure system;
• Conventional and multiple pressure sensor spacing with impedance and HRM;
ESOPHAGEAL MANOMETRY TESTING: A rapidly changing technology

- **WATER PERFUSION** - single intralumen/side port, pull-through method;

- **SOLID STATE (ELECTRONIC)** – limited channels spaced apart, pull-through method;

- **HIGH DEFINITION/IMPEDEENCE & HIGH RESOLUTION** - multichannel pressure sensors and impedance electrodes;
ESOPHAGEAL MANOMETRY TESTING: A rapidly changing technology

INTRALUMINAL OR LIMITED CHANNEL CATHETER
ESOPHAGEAL MANOMETRY TESTING: A rapidly changing technology

HIGH DEFINITION (IMPEDENCEness) –
- Multiple channels with pressure transducers and impedance electrodes;
- Concurrently measures bolus transit and esophageal body/sphincter pressure changes;

HIGH RESOLUTION (HRM)- axial measurement or “real time” of all events occurring during a swallow episode;
ESOPHAGEAL MANOMETRY TESTING: A rapidly changing technology

combined impedance & manometry catheter

combined impedance-manometry recording
ESOPHAGEAL MANOMETRY TESTING: A rapidly changing technology

High Resolution Manometry (HRM) -
- 36 Pressure and 18 Impedence sensors
- All circumferential sensors
- Display pressure and bolus transit
ESOPHAGEAL MANOMETRY TESTING: High Resolution Manometry (HRM)

TECHNOLOGY –
- not new technology but a refined methodology;
- greater detail (conversion of waveform to color display);
- an esophageal motor event in a space-time continuum;

DATA INTERPRETATION –
- added benefit is a simplified data interpretation;
- can be achieved with less training;
ESOPHAGEAL MANOMETRY TESTING: High Resolution Manometry (HRM)

UNDERLYING CONCEPT –
by vastly increasing the number of sensors and reducing the space in between the sensors there is improved representation of the entire esophagus pressure profile;

CHALLENGES –
• increased quantity of data;
• the resulting need to develop new algorithms;
ESOPHAGEAL MANOMETRY TESTING: What are we looking for?

Approach to Analysis of Esophageal Manometry

- Detectable LES pressure > 5 mmHg?
  - Actual resting LES pressure?
- Complete LES relaxation with swallowing?
  - Nadir pressure? Duration?
- Esophageal pressure waves >10 mmHg at all sites?
  - Site of failure?
- Pressure waves peristaltic?
  - Simultaneous?
- Pressure waves above effective amplitude?
  - Wave amplitude?
- Do motor patterns explain symptoms?

COMMON TERMS:
- LES (abbreviation) - Lower Esophageal Sphincter
- NADIR (Definition) – resting sphincter pressure
- UES (ABBR)
ESOPHAGEAL MANOMETRY TESTING: What are we looking for?

www.sierrainstruments.org website provides video tutorials of waveform and contour plots.
ESOPHAGEAL MANOMETRY TESTING: Challenging cases!

HIATAL OR PARAESOPHAGEAL HERNIA

TIGHT ACHALASIA

ZENKER’S DIVERTICULUM
HELLO, I’M MR. ANXIETY NEUROSES. I WANT TO FEEL NOTHING AND I HAVE A REALLY BAD GAG REFLEX!

THE GI LABORATORY: A CALM AND PATIENT CENTERED ENVIRONMENT

ESOPHAGEAL MANOMETRY TESTING: CASES THAT TEST YOU!
ESOPHAGEAL MANOMETRY TESTING: A great opportunity for nursing research


- Studied 103 patients (52f, 51m; 53 + 14.9yrs) who underwent conventional esophageal manometry;
- Conclusion: “Although patients are not really fond of esophageal manometry, the vast majority of them find the procedure acceptable and would be willing to undergo a repeat procedure. Most patients prefer upper GI-endoscopy to esophageal manometry, which is probably mainly a matter of iv sedation”.

Prospective Trial Using Virtual Vision® as Distraction Technique in Patients Undergoing Gastric Laboratory Procedures. Seattle, WA. (1996). Kozarek, Richard A. MD; Raltz, Shirly L. MSN, RN; Neal, Lillian RN; Wilbur, Patricia RN; Stewart, Sally RN; Ragsdale, Jill BSN, RN.

Conclusion: “Following a standardized approach, both patients and NURSES reported that VV was a valuable distraction technique (88% and 86%, respectively). Moreover, 26 of 33 patients (79%) who had undergone previous gastric laboratory testing preferred distraction therapy to previous testing and a total of 41 of 50 patients (82%) would use VV again in conjunction with conventional testing”.
ESOPHAGEAL MANOMETRY TESTING: Patient preparation

PRIOR TO TEST DATE:
• Written pre-procedure instructions;
• Telephone interview 1-2 days prior;

DAY OF PROCEDURE:
• NPO 4 hours prior and off medications 24 hours prior;
• Teaching and Informed consent;
• Calming measures – music, privacy, a picture or other visual focus and anxiolytic sedation (if indicated);
• Patient position – comfortably reclining or standing;
ESOPHAGEAL MANOMETRY TESTING: An example of standard nasal intubation

• **TOPICAL** – Lidocaine 2% gel to nare and Hurricaine spray to throat;
• **CATHETER** – Lubricated with lidocaine 2% gel;
• **SEDATION** – Versed 0.5 mg incremental dosing, max. 3 mg (optional for anxiety or severe gagging);
• **GASTRIC BASELINE** – Catheter is swallowed with sips of water until the gastric baseline is obtained;
• **WATER BOLUS** – Start with 2 ml (test) amount and progress to 5 ml amount for the esophageal analysis;
ESOPHAGEAL MANOMETRY TESTING: An example of wire-guided nasal intubation

- **TOPICAL** – Lidocaine 2% gel to nare and Hurricaine spray to throat;
- **CATHETER** – Lubricated with lidocaine 2% gel;
- **PATIENT POSITION** – Lateral recumbent (straighten torso for large hiatal hernia);
- **WATER BOLUS** – Start with 2 ml (test) amount and progress to 5 ml amount for the esophageal analysis after the patient is awake enough to effectively swallow;
ESOPHAGEAL MANOMETRY TESTING: An example of wire-guided nasal intubation

• SEDATION – versed and fentanyl according to MD discretion;
• MONITORING – Follow your institutional guidelines for sedated patients post-procedure;
• GASTRIC BASELINE –
  ✓ a flexible coated guidewire .035 is inserted through an ultrathin or pediatric endoscope;
  ✓ the wire-guided catheter is inserted over the guidewire until a gastric baseline is obtained and prior to starting the study;
<table>
<thead>
<tr>
<th>Related pearls from the field</th>
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<tr>
<td><strong>ESOPHAGEAL MANOMETRY TESTING:</strong></td>
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<td><strong>THE ANXIOUS PATIENT AND EXCESSIVE SWALLOWER:</strong></td>
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<td>• COMFORTABLE POSITION AND FOCUS - I.E. Lay the patient on their side to reduce probe stimulation and gagging or by facing toward a monitor image;</td>
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<td>• ENVIRONMENT OF CARE - A less anxious patient leads to improved study cooperation and outcomes;</td>
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<td>• MOUTH KEPT OPEN – It helps to gently rest a finger on the lower lip to prevent the urge to repeatedly swallow between water bolus‘;</td>
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<td>• ALLOW 5 – 10 MINUTES TO ACCLIMATE – This is time well spent to allow time to adjust to the catheter and to relax;</td>
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Esophageal manometry testing:
Related pearls from the field

Catheter intubation:
1. Oral intubation – Not the preferred approach because it causes more gagging and makes it harder for the patient to initiate a swallow;
2. Passing the catheter – ask the patient to:
   • Refrain from swallowing until the catheter has reached the nasopharynx because the soft palate moves up with a swallow to create resistance;
   • Bend their chin toward their chest after the catheter reaches the nasopharynx and before providing small sips of water to “swallow” the catheter;
ESOPHAGEAL MANOMETRY TESTING:
Related pearls from the field

CATHETER INTUBATION:

SUSPECTED ACHALASIA –
• Expect a fluid filled esophagus and attempt passing the catheter without water sips to avoid gagging;
• Screen ahead of the procedure date for consideration of a wire-guided approach;
ESOPHAGEAL MANOMETRY TESTING: RELATED PEARLS FROM THE FIELD

CATHETER COILING:

- Withdraw the catheter
- Reposition the patient, i.e. Standing or turning to a side;
- Re-advance slowly the catheter while the patient is swallowing water to prevent further coiling;
ESOPHAGEAL MANOMETRY TESTING:
Related pearls from the field

GASTRIC BASELINE RECOGNITION –

• Ask the patient to take a deep breath to recognize pressure changes;
• Use all methods of manometric recognition, i.e. color contour plot and waveform analysis, (dark blue and a positive or upward waveform indicates the catheter location is in the stomach);
• Use a Hernia sac as a baseline if catheter coiling continues (pull back the catheter until the LES is identified and above the diaphragmatic hernia;
ESOPHAGEAL MANOMETRY TESTING:
Related pearls from the field

FOR THOSE CURRENTLY USING A WATER PERFUSION CATHETER -

- **PATIENT POSITION** – To prevent pressure artifact
  - ✔ Needs to be recumbent;
  - ✔ Keep the chest parallel to the floor;
- **FLAT LINE?** verify the water is turned on;
- **SLOPED SWALLOW CONTRACTION WAVEFORM WITH JAGGED EDGES?**
  - ✔ Ensure all lines and transducers are bubble free before calibration;
  - ✔ Tap transducer or tubing to dislodge any air bubbles;
ESOPHAGEAL MANOMETRY TESTING: Related pearls from the field

FOR THOSE CURRENTLY USING A WATER PERFUSION CATHETER -

• UES STUDIES — Not accurately performed due to water perfusion dripping in the pharynx and the positioning requirements of the pressure system;

• WANDERING GASTRIC BASELINE? Reposition the catheter away from gastric secretions, wall or folds;

• TEMPERATURE FACTOR – the catheter requires time to warm to the body temperature to avoid erratic pressure or waveform variations;
ESOPHAGEAL MANOMETRY TESTING: Related pearls from the field

pH CATHETER INSERTION:

• pH catheter placement is 5 cm above the LES;
• “C” (curved) shape to the catheter’s distal tip helps passage into the nasopharynx;
• First insert the pH catheter into the stomach to document a gastric pH (usually 1.8 - 2.5 pH) and then pull back the catheter to the recommended depth (5 cm above LES);
ESOPHAGEAL MANOMETRY TESTING:
Related pearls from the field

pH CATHETER INSERTION:

Large hiatal hernia with catheter coiling and gagging?
Stop there, note the pH level and pull back to 5 cm above the LES
ESOPHAGEAL MANOMETRY TESTING:
A whole team effort!

SUPPORT STAFF:

• MD assigned to a study;
• Other experienced colleague to do a conjoint case review (either during test acquisition or analysis);
• Online support (follow your written facility policy for patient privacy concerns and HIPAA);
• Clinic staff written instructions and referral appointments;
• SBAR Protocol for follow-up and quality review of a case outcome;
REFERENCES:


2. J. E. Pandolfino, M. R. Fox, A. J. Bredenoord & P. J. Kahrilas (2009). High-resolution manometry in clinical practice: utilizing pressure topography to classify oesophageal motility abnormalities. NEUROGASTROENTEROLOGY. Department of Medicine, The Feinberg School of Medicine, Northwestern University, Chicago, IL, USA.

