Learning Objectives

• Understand the principles of Esophageal Impedance measurement

• Analyze the indications and limitations of the technique.

• Discuss the advantages and disadvantages with respect to pH probe.

• Consider the clinical conditions in which impedance is recommended

WHAT IS IMPEDANCE?

Opposition to Current Flow
Inverse measurement of the electrical conductivity of an organ’s wall & contents

WHY DOES IMPEDANCE CHANGE?

No bolus = few ions = high impedance

Bolus present = many ions = low impedance

IMPEDANCE RANGE

Low Conductivity = High Impedance

Air (high)
Esophageal Lining
Saliva
Food
Refluxate (low)

Multichannel intraluminal impedance device and size of Pediatric catheters
Nonacid GER Episode

Acid GER

Acid Reflux

Background

- Infants reflux frequently
- Often, reflux cannot be detected with a pH sensor during the postprandial period due to buffering effects of the meal
- Reflux is most likely to occur in the postprandial period due to gastric distention
- Symptom correlation is not easy in infants because they do not speak.
What can we do with MII-pH?

- Measure acid - weakly acid and non-acid reflux
- Correlate acid and non-acid reflux to symptoms
- Determine height of proximal migration
- Determine bolus clearance time (MII)
- Determine acid - non acid clearance time (pH)

Benefits of MII over pH probe

- Evaluate patient with persistent symptoms while on PPI
- Evaluate atypical GERD
  - Correlate acid & non-acid GER episodes with symptoms
  - Quantify proximal extent of GER
- Evaluate postprandial GER
  - pH is blind during early postprandial period
  - Postprandial is prime time for reflux and symptom occurrence

Clinical Benefits

- MII-pH Monitoring detects all reflux during the entire analyzed time period
- Symptom correlations are made with both acid and nonacid reflux
- MII-pH Monitoring sensitivity is not compromised during the postprandial time period
- A true postprandial reflux study is possible

Potential MII-pH Advantages

- Diagnosis of patient with persistent symptoms while on PPI medication
  - Elucidate the role of non-acid GER
- Evaluation of atypical GERD
  - Correlate acid & non-acid GER episodes to Symptoms
  - Quantify proximal extent of GER
- Evaluate Postprandial GER
  - pH is blind during early postprandial period
  - Postprandial is prime time for reflux & symptoms

Digestive presentations

Extraesophageal Presentations
Chemical clearance is significantly prolonged during fasting in infants.

• Falling pH alone cannot explain declining chemical clearance efficiency during later postprandial periods.

• Authors speculate that inefficient chemical clearance during fasting is likely due to reduced efficiency of acid clearance mechanisms that could include salivation, swallowing, peristalsis, and/or intraluminal secretion.
Esophageal pH monitoring is useful for evaluating the efficacy of antisecretory therapy. It may be useful to correlate symptoms (e.g., cough, chest pain) with acid reflux episodes and to select those infants and children with wheezing or respiratory symptoms in whom GER is an aggravating factor.

The sensitivity, specificity, and clinical utility of pH monitoring for diagnosis and management of possible extraesophageal complications of GER are not well established.

24 hr pH study

- Esophageal pH monitoring is useful for evaluating the efficacy of antisecretory therapy. It may be useful to correlate symptoms (e.g., cough, chest pain) with acid reflux episodes and to select those infants and children with wheezing or respiratory symptoms in whom GER is an aggravating factor.

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Journal of Pediatric Gastroenterology and Nutrition, 2009; 49:498

24 hr Impedance / pH study

- Measurement of other parameters such as SI or SAP may be of additional value to prove symptom association with reflux, especially when combined with MII.

- Whether combined esophageal pH and impedance monitoring will provide useful measurements that vary directly with disease severity, prognosis, and response to therapy in pediatric patients has yet to be determined.

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Esophageal Impedance Monitoring for Gastroesophageal Reflux

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Esophageal Impedance Monitoring for Gastroesophageal Reflux

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Abstract

Dual pH-multichannel intraluminal impedance (pH-MII) is a sensitive tool for evaluating overall gastroesophageal reflux disease, and particularly for permitting detection of nonacid reflux events. pH-MII technology is especially useful in the postnatal period or at other times when gastric contents are nonacidic. pH-MII was recently recognized by the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition as being superior to pH monitoring alone for evaluation of the temporal relation between symptoms and gastroesophageal reflux. In children, pH-MII is useful to correlate symptoms with reflux (particularly nonacid reflux), to quantify reflux during late feeding and the postprandial period, and to assess efficacy of antireflux therapy. This clinical review is simply an evidence-based overview addressing the indications, limitations, and recommended roles for the clinical use of pH-MII in children.

Evaluation of infantile acid and nonacid gastroesophageal reflux using combined pH monitoring and impedance measurement.

Condino A Sundheim, I et al., JPGN, 2006;42:16

- MII detects more reflux events than pH monitoring alone.
- The proportion of nonacid reflux to acid reflux events in infants is more similar to adults than previously reported.
- Combined pH-MII esophageal monitoring identifies more reflux events and improves clinical correlation with symptoms.

Combined multichannel intraluminal impedance-pH monitoring to select patients with persistent gastro-oesophageal reflux for laparoscopic Nissen fundoplication


Patients with a positive symptom index resistant to PPIs with non-acid or acid reflux demonstrated by MII-pHmonitoring can be treated successfully by laparoscopic Nissen fundoplication.

Acid gastroesophageal reflux reports in infants: a comparison of esophageal pH monitoring and multichannel intraluminal impedance measurements.

Woodley M. Meuse H. JPGN; 2002;42:319

Detection of significant number of “pH-only” episodes raises concerns regarding possible over-estimations of acid exposure that may occur when estimates are based solely on esophageal pH monitoring.

The Importance of Multichannel Intraluminal Impedence in the Evaluation of Children with Persistent RespiratorySymptoms.

Rosen R, Nurko S. Am J Gastroenterol 2004;99:2452

Nonacid reflux may be an important predictor of respiratory symptoms.

pH/MII provided important information in the evaluation of children with intractable respiratory symptoms.
Evaluation of gastroesophageal reflux with the MII-pH probe in children with respiratory symptoms.

Orsi M, Cohen Sabban J, Donato Bertoldi G, D’Agostino D.

- To evaluate the proportion of acid or non-acid episodes of gastroesophageal reflux in children with respiratory symptoms.
- To determine the symptom correlation and the height of the episodes.

Results

- In the 45 children studied: 1850 reflux episodes observed, 1179 (63.7%) acid and non-acid: 671 (36.2%).
- The pH probe detected 984 acid events.
- The proximal channel was reached in 152 (62.2%) episodes: 65% acid and 35% non-acid of them.
- Symptomatic correlation with cough:
  - Total: 420, Acid 211 (50.3%) and Non-acid 209 (49.7%).

Conclusions

In respiratory patients, the 24-hour Multichannel Intraluminal Impedance-pH monitoring resulted a good method to study gastroesophageal reflux because is capable of providing a more dynamic and complete information of the different types of reflux events. Other studies are necessary to help us understand the benefits and / or limits of this new technology.
Values for NAGER percent time, NAGER episode frequency, frequency of proximal NAGER, and mean NAGER duration were calculated for upright position, recumbent, and total.

Study population consisted of

46 infants (20 F/26 M, median age 4.8 months [range 3 weeks–11.9 months] with a median AGER index of 2.2 % (range 0.0–5.9 %) and

71 children (22 F/49 M, median age 7.2 years [range 1.3–17 years]) with a median AGER index of 1.1% (range 0.0–3.0 %).

The results of this study provide a range of values characteristic of infants and children with normal AGER indices and no positive temporal associations of GER with symptoms

These values may be used as references for comparison to identify infants and/or children who may be at risk of developing serious clinical manifestations due to abnormal patterns of GER.

Take home message

- Ambulatory practice.
- Detects acid, weakly acid & non acid reflux
- Height of the episode.
- Study patients on PPI, refractory to treatment.
- Correlate symptoms to all types of GER
- Analyze bolus acid / non acid clearance time
- Is not blind in post prandial period.
- Differentiates if changes of pH are due to a swallow or reflux
- Adds information to conventional pH monitoring
- Helpful in extraesophageal presentations, complex patients and surgical decisions.
- BUT
- Manual Data Analysis is time consuming and there may be variability of interpretation.
Any questions?