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Impedance Planimetry and the Changing Paradigm of Esophageal Dysphagia

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Abstract

Objectives: Patients presenting with dysphagia can encounter a pathway to therapy and relief that is expensive and frustrating. High resolution impedance planimetry (HRIP) is a new mechanism for enhancing and possibly hastening that process. A balloon with integrated pressure sensors is utilized to measure luminal geometry and pressure by volume-controlled distention. Esophagogastric junction (EGJ) distensibility and body contractility are assessed at the time of other endoscopic procedures. Here we describe a single-center experience utilizing HRIP in the endoscopic evaluation of patients presenting with dysphagia.

Methods: A prospectively maintained registry of patients undergoing impedance planimetry assessments at an academic medical center was queried for demographics, procedural details, and patient-reported outcomes.

Results: Data was reviewed for 122 procedures performed by two providers. HRIP was performed in 63 (52%) patients for initial dysphagia assessment, 36 (30%) for follow-up assessment, and 20 (16%) as a procedural adjunct at the time of other planned procedures. HRIP contractile response was characterized as normal in 36%, absent in 32%, and diminished/disorganized in 14%. These results motivated clinical planning for surgical referral in 7 (5%) patients, 31 (26%) additional testing, and 82 (68%) continued medical management and follow-up.

Discussion: HRIP is an emerging endoscopic modality which can streamline diagnostic work-up and therapeutic planning for patients with symptomatic dysphagia. Using functional esophageal assessment at the time of other diagnostic and therapeutic procedures, HRIP may expedite care and lead to improved patient satisfaction and clinical outcomes.

Keywords

endoscopy, esophagus/foregut, gastrointestinal, impedance planimetry, functional lumen impedance planimetry

Key Takeaways

- The use of high resolution impedance planimetry in endoscopic evaluation of patients presenting with dysphagia can expedite diagnostic work-up and alleviate patient discomfort, cost, and time off work.
- Utilization of functional esophageal testing at initial endoscopy for dysphagia assessment allows patients to receive therapeutic intervention and streamline treatment choices.

Introduction

The differential diagnosis for dysphagia is vast, and the pathway to therapy and symptom relief is often expensive and frustrating for patients. In about half of patients, the cause of symptoms will not be found on index endoscopy,

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Table 1. Patient characteristics.

	n = 122
Gender (% female)	33%
Race (% black)	55%
Initial BMI (kg/m2)	31.8 +/− 10.4
Diabetes	25%
Hypertension	67%
Obstructive sleep apnea	27%
Gastroesophageal reflux	69%
On proton pump inhibitor	70%
On H2 blocker	26%

Table 2. Initial assessment patient characteristics.

	n = 63
Gender (% female)	70%
Race (% black)	54%
Initial BMI (kg/m2)	32.3 +/− 11.2
Diabetes	29%
Hypertension	65%
Obstructive sleep apnea	29%
Gastroesophageal reflux	75%
On proton pump inhibitor	67%
On H2 blocker	29%

leading to more follow-up appointments and further invasive testing.[1] Should an esophageal motility disorder be expected following initial endoscopy, the current gold standard is the use of high resolution manometry (HRM) to assess integrated relaxation pressure (IRP) and primary peristalsis.[2] However, the trans-nasal approach for catheter placement during manometry testing is associated with patient discomfort, cost, and can be inconclusive.[3] High resolution impedance planimetry (HRIP) is a new mechanism for enhancing and possibly hastening the process of diagnosis and treatment. The functional lumen imaging probe (EndoFLIP®, Medtronic, Fridley MN) is a device capable of measuring cross sectional area and intraluminal pressure under distention, which can then be used to calculate esophagogastric junction (EGJ) distensibility.[4] This allows for gastroesophageal functional assessment at the time of other endoscopic procedures, potentially expediting diagnostic work-up and streamlining clinical decision-making. Studies have shown that HRIP is a well-tolerated method to assess esophageal contractile response, EGJ distensibility, and may provide an alternative and complementary method for evaluation of dysphagia.[3] Here we describe a single-center experience utilizing HRIP in the endoscopic evaluation of patients presenting with dysphagia.

Materials and Methods

As a quality improvement project, a prospectively maintained registry of patients that underwent HRIP between June and November of 2020 at an academic medical center was reviewed. Demographics, comorbidities, and details of the procedure including volumes assessed with corresponding distensibility index (DI) and minimum diameter (Dmin), motility pattern, and any other interventions or diagnostic tests performed were reviewed. Follow-up data including subjective improvement of symptoms and other procedures or testing performed since FLIP assessment were recorded. Standard univariate statistics were used to identify statistical differences in primary and secondary outcomes. Standard linear and logistic regression methods were used to adjust for differences in baseline patient characteristics and type of intervention on outcomes. Data is presented as mean (SD) when parametric, median (IQR) when non-parametric, or frequency (%). A P-value of $<.05$ was considered statistically significant.

Results

Data was reviewed for 122 procedures performed by two providers (1 surgeon, 1 gastroenterologist). The patients were 67% female and 55% Black; mean body mass index (BMI) was 31.8 +/− 10.4. Relevant comorbidities included diabetes in 25%, hypertension in 67%, obstructive sleep apnea in 27%, and a clinical diagnosis of gastroesophageal reflux disease (GERD) in 69%. More than 70% of patients were on a proton pump inhibitor and 25% on an H2-blocking agent at the time of evaluation (Table 1). Prior to HRIP, 19% had undergone manometry, 42% had undergone endoscopy, and 8% had undergone pH probe monitoring. HRIP was performed in 63 (52%) patients for initial dysphagia assessment, 36 (30%) for follow-up assessment, and 20 (16%) as a procedural adjunct at the time of other planned procedures. Sixty-eight (56%) were performed together with additional diagnostic procedures, including 65 biopsies for eosinophilic esophagitis and 5 pH probe insertions for non-erosive reflux disease (NERD). HRIP measurements were characterized as normal in 36%, absent in 32%, and diminished/disorganized in 14%. These results motivated clinical planning for surgical referral in 7 (5%) patients, 31 (26%) additional testing, and 82 (68%) continued medical management and follow-up. Of patients with follow-up data, 38 (53%) required additional diagnostic testing, 31 (36%) required further procedures, and 46 (59%) patients reported subjective improvement in symptomatology.

Of the 63 patients for whom HRIP was the initial diagnostic procedure, 70% were female and 54% were Black; mean BMI was 32.3 +/− 11.2. All other patient characteristics included in Table 2. During these 63 HRIP procedures for initial evaluation, concomitant diagnostic

procedures were performed in 42 (67%) patients, including biopsy for eosinophilic esophagitis (EoE) in 39 (62%) and pH monitor placement in 4 (6%) patients. Concomitant interventions were performed in 13 (21%) patients, including Botox injection in 11 (17%) for DI and Dmin reflective of achalasia, and dilation in 2 (3%). Of the new dysphagia evaluations, only 14 (22%) patients required further diagnostic procedures and 18 (29%) required further therapeutic interventions after index HRIP, leaving just over 50% who were either treated or alleviated the need of further testing.

Discussion

Patients presenting with symptoms of dysphagia have a differential diagnosis that includes GERD, eosinophilic esophagitis (EoE), malignancy, hiatal hernia, diffuse esophageal spasm (DES), or ineffective esophageal motility (IEM) to name a few. Initial workup would include a trial of proton pump inhibitors and often endoscopy.[5] If the cause of symptoms is not evident with endoscopy—as in hiatal hernia, stricture, esophagitis, or malignancy—additional investigations are needed. With no objective data, this could mean separate trips for high resolution manometry, pH study, extending the PPI trial, or additional radiographic work-up.[2] This is a time consuming and costly endeavor both in direct and indirect cost to the patient, as well as multiple sedations or often traumatic awake procedures.

The FLIP catheter is a series of electrodes that measures the cross sectional area of the lumen while simultaneously measuring the pressure within the bag, which is then used to calculate the distensibility index.[6] FLIP HRIP is distinctively suited for evaluation of esophageal function during sedated endoscopy due to the ability to simultaneously measure luminal diameters and pressure during controlled distension through the body of the esophagus and EGJ.[7] Because interpretation of HRIP is performed in real-time, diagnoses can be ruled in or out, and often treatment initiated at the time of index of endoscopy.[6] In our series, 68% of patients were able to avoid additional testing by ruling out major motility disorder in addition to the standard benefits of evaluation by endoscopy. We believe that using functional esophageal assessment at the time of other diagnostic and therapeutic procedures may expedite care and lead to improved patient satisfaction and clinical outcomes. Even in this real-world clinical practice scenario without additional changes to protocols, we identified and treated 11 probable achalasia patients by HRIP and avoided repeat endoscopy by placing pH probes in 4 (6%). Of 63 index endoscopies, only 14 went on to additional testing.

The current Food and Drug Administration approved indications for HRIP are for use in the clinical setting to measure pressure and dimensions in the esophagus, pylorus, and anal sphincters and as an adjunct to other diagnostic methods as part of a comprehensive evaluation of patients with symptoms consistent with gastrointestinal motility disorders.[8] As seen with our patients, in addition to HRIP for functional testing, patients underwent other diagnostic procedures including biopsies for EoE and pH probe insertions for reflux testing. Performing all diagnostic tests at the initial encounter will decrease the need for additional appointments and will ideally provide symptomatic improvement much earlier.

This prospectively collected and retrospectively reviewed database serves as a useful quality improvement tool with obvious limitations. Selection and referral bias are implied in a single center study of referrals and may not translate into community gastroenterology practice. Improved protocols for holding patients' PPI prior to all index endoscopies would allow for more accurate assessment of erosive esophagitis and more frequent placement of pH probes under sedation when indicated for NERD. Further research is ongoing toward standardizing the relationship between HRM and HRIP, and guidelines should reflect the appropriate use of HRIP as a diagnostic adjunct to our existing armamentarium.

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