ADVANCES IN GERD

Current Developments in the Management of Acid-Related GI Disorders

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High Resolution Manometry Vs Conventional Line Tracing for Esophageal Motility Disorders

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G&H How are the various esophageal motility disorders classified?

RY The Chicago Classification categorizes esophageal motility disorders based on high resolution manometry esophageal pressure topography metrics. The Chicago Classification was first introduced in 2009 and is based on the work of the International High Resolution Manometry Working Group. The Chicago Classification has since undergone updates and is currently in version 3.0.

G&H When is esophageal manometry recommended?

RY Esophageal manometry is used to assess nonobstructive dysphagia, esophageal motility prior to antireflux intervention or surgery, symptoms such as regurgitation, heartburn, and noncardiac chest pain, and gastroesophageal reflux disease nonresponsive to proton pump inhibitor therapy.

G&H How does high resolution manometry compare to conventional line tracing?

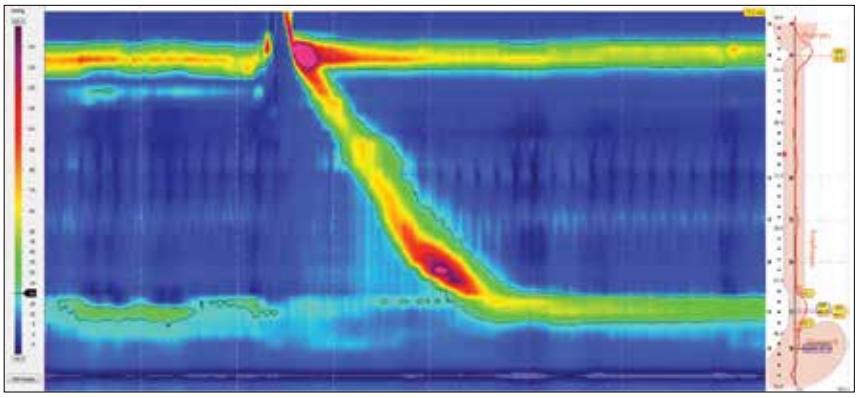
RY Esophageal manometry systems transmit data through catheters containing pressure sensors. The catheter is placed transnasally and ideally should traverse the esophagogastric junction. The pressure sensors capture intraluminal pressure signals and transfer those signals to a receiving device, which records and displays data.

Distinguishing features between the 2 manometry systems include catheter design and data display. In high resolution manometry, the catheter has multiple (up to 36) pressure sensors spaced 1 cm apart along the catheter, whereas conventional manometry catheters typically have 5 pressure sensors spaced widely apart. Thus, high resolution manometry generates multiple line tracings. In addition, high resolution manometry data are displayed via esophageal pressure topography, which produces dynamic colorful spatiotemporal topography plots to depict pressure changes along length and time as opposed to conventional line tracings (Figure). High resolution manometry is a technologic evolution from conventional line tracing.

G&H How is high resolution manometry performed?

RY High resolution manometry can be performed in the supine or seated position; the Chicago Classification is based on metrics derived from normative data in the supine position. Following catheter placement, a baseline period is typically identified. The baseline period is a time in which the patient is resting and refraining from swallowing, and should ideally last 30 seconds. During the baseline period, interpreting physicians are able to detect landmarks such as the location of the upper or lower esophageal sphincter, ensure that the catheter is in the correct position by identifying a pressure inversion point, and characterize the esophagogastric junction morphology. Studies suggest that the baseline period can be obtained later in the study without compromise.

Esophageal motility is assessed on swallows. Typically, a series of at least 7 to 10 high-quality, 5-mL water swallows should be performed. In addition to the



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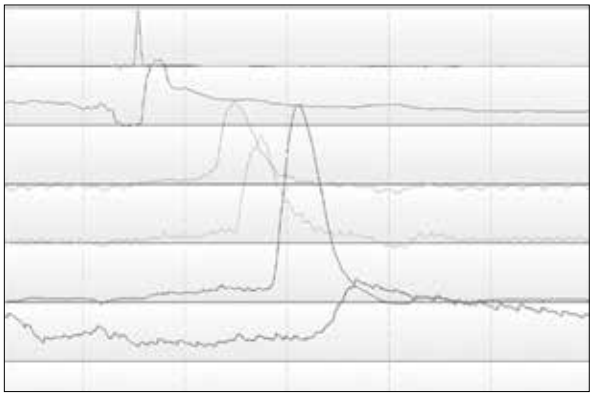

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Figure. A high resolution manometry esophageal pressure topography plot (**A**) and the corresponding line tracing (**B**) display esophageal contractility and deglutitive relaxation in response to a swallow. Time is plotted on the horizontal axis, and catheter length is on the vertical axis. The high resolution manometry esophageal pressure topography plot displays a heat map that corresponds to pressure in units of mm Hg, with blue representing low pressures and red representing high pressures.

Manometry tracings reproduced with permission from the Esophageal Center at Northwestern Medicine Digestive Health Center.

standard protocol of a baseline period with a series of 10 wet swallows in the supine position, protocols may include wet swallows in the seated position, swallows with viscous or solid bolus, multiple rapid swallows, and rapid water bolus. In patients with nonresponse to proton pump inhibitors or those with a suspicion of a belching or rumination syndrome, physicians may perform a postprandial, high resolution impedance study.

G&H How significant is the learning curve for high resolution manometry and conventional line tracing?

RY There is not a substantial amount of data regarding the learning curve for these techniques. In general, studies demonstrate a quicker learning curve and a higher agreement between raters with high resolution manometry compared to conventional line tracing. Certain motility patterns such as achalasia seem to be more readily identified compared to other motility disorders. However, a recent study that my colleagues and I conducted among 20 novice trainees found that learning curves varied among trainees and the majority of trainees did not achieve competency in interpretation after 50 cases. Thus, despite several important advances, the interpretation of high resolution manometry remains complex.

G&H What advantages and limitations are associated with both techniques?

RY The only identifiable advantage of conventional line tracing over high resolution manometry is cost, although the cost of either system is not readily available. While the exact numbers are unknown, high resolution manometry is more expensive than conventional line tracing. As alluded to previously, there are several advantages of high resolution manometry over conventional line tracing. High resolution manometry provides an illustrative depiction of esophageal motility compared to conventional line tracing and results in increased diagnostic accuracy of motility disorders. High resolution manometry also allows identification of anatomic landmarks and assessment of hiatal hernia, and demonstrates pressurization patterns. In addition, impedance

combined with high resolution manometry provides valuable information regarding bolus transit, reflux episodes, rumination syndrome, and belching disorders.

G&H Which esophageal motility disorders can these techniques be used to detect?

RY Esophageal motility patterns are classified as major motility disorders, minor motility disorders, or normal motility. Major motility disorders are patterns not found in normal, healthy controls as opposed to minor motility disorders. Major motility disorders are separated into disorders with abnormal deglutitive lower esophageal sphincter relaxation (achalasia subtypes I, II, III; esophagogastric junction outflow obstruction) and disorders with normal deglutitive lower esophageal sphincter relaxation (hypercontractile esophagus, absent contractility, distal esophageal spasm). Minor motility disorders include ineffective esophageal motility and fragmented peristalsis.

G&H What is the reliability of these diagnostic tests?

RY In 2015, Dr Dustin Carlson and colleagues compared interpreter diagnostic accuracy when using high resolution manometry compared to conventional line tracing. Six experienced gastroenterologists and 6 novice trainees participated in this study. The authors found that overall interrater agreement and diagnostic accuracy were greater for high resolution manometry compared to conventional line tracing. In addition, the interrater agreement was higher among experts as compared to trainees.

G&H Can high resolution manometry and conventional line tracing be used in pediatric as well as in adult patients?

RY Manometry systems are widely used in the pediatric population, although the validated metrics applied in the Chicago Classification depend on esophageal length and, thus, cannot necessarily be extrapolated to pediatric patients. In pediatric cases, esophageal length may need to be considered. In addition, application of adult metrics can result in an overdiagnosis of abnormal motility patterns. It is also important to recognize that manometry may not be as well tolerated in the pediatric population and may require catheter placement under sedation.

G&H Are there any patients in whom either technique should be avoided?

RY There are a few contraindications for both techniques. An evaluation for an obstructive esophageal process should always precede manometric evaluation of dysphagia. Cognitive impairment may preclude a patient's ability to follow swallowing instructions during the study protocol. Patients with significant bleeding disorders, patients unable to stop antiplatelet or antithrombotic agents, and patients at significantly high aspiration risks may not be able to undergo manometry.

G&H What are the priorities of research in this field?

RY Over the past 20 years, esophageal manometry has proven to be an indispensable research and clinical tool in understanding esophageal physiology and characterizing motility patterns. Currently, there is great interest in exploring how manometric findings predict response to treatments. In addition to esophageal motility, high resolution manometry provides valuable information about upper esophageal sphincter activity as well as the antireflux barrier, and, thus, there is interest in using high resolution manometry to characterize gastroesophageal reflux disease and oropharyngeal dysphagia mechanisms. Research is ongoing to identify high resolution manometry metrics for bolus transit, rumination and belching syndromes, and mechanisms of proton pump inhibitor nonresponse. There is also ongoing interest in standardizing the training for high resolution manometry interpretation and developing methods to assess interpreter competency.

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Suggested Reading

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