



## **High-Resolution Esophageal Manometry**

This chapter addresses high-resolution manometry (HRM) of the esophagus. Evaluation of esophageal physiology is imperative in patients across the spectrum of swallowing disorders. While esophageal fluoroscopy and endoscopy are key components to the workup of patients with symptoms of dysphagia, they are unsatisfactory in diagnosing disorders of esophageal motility. With the advent of HRM, understanding of esophageal function has greatly improved and allowed a more precise classification of esophageal motility disorders leading to more suitable treatments.

### **Upper Aerodigestive Tract Anatomy and Physiology:**

- a. Anatomy, Physiology, & Function:
  - a. Pharynx and Upper Esophageal Sphincter (UES):
    - i. Frequently HRM is utilized as a research tool for the diagnosis and management of oropharyngeal dysphagia and normative data are still being delineated<sup>1-3</sup>. HRM provides details of palatal, lingual, and hypopharyngeal peak pressures and UES baseline as well as relaxation data. The proximal sensor for the HRM catheters are positioned into the nasopharynx so the above anatomical regions may be evaluated.
  - b. Esophageal Body:
    - i. Esophageal motor function has been amply studied using HRM. Regions within the esophagus are categorized into four contractile segments (S1-S4). S1 incorporates the proximal skeletal muscle, S2 includes the proximal smooth muscle contraction, S3 includes the distal smooth muscle contraction and S4 corresponds to the lower esophageal sphincter (LES). The examining clinician must be familiar with several manometric parameters for the thorough evaluation of the esophageal body including the isobaric contour line, contraction front velocity (CFV), contractile deceleration point (CDP), distal latency (DL), distal contractility integral (DCI), intrabolus pressure (IBP). The Chicago Classification of esophageal motility disorders<sup>4</sup> (CC v3.0) is in its third iteration of the International HRM Working group and it provides classification of abnormal esophageal motility based upon values of the above measures.
  - c. Esophagogastric Junction (EGJ):
    - i. This 3 cm region of high pressure, with primary contributions from the intrinsic LES and crural diaphragm (CD), is fundamental in protecting against the regurgitation of stomach contents into the esophagus while its relaxation is vital to allow nutrition to pass from the esophagus to the stomach. HRM affords accurate and reliable baseline and relaxation EGJ pressures.

### **Assessment:**

- a. Introduction:
  - a. It is essential for clinicians caring for the dysphagia patient to maintain a comprehensive understanding of the diagnosis and management of esophageal motility disorders. Having a clear understanding of the CC v3.0<sup>4</sup> is vital to understand and diagnose abnormal esophageal motility.



- b. In patient's undergoing HRM it is important for patients to have undergone esophageal fluoroscopy and esophagoscopy to rule out obstructive and mucosal pathology that may be contributing factors to patient symptoms. These also help with understanding esophageal pathology that may impact the ease, safety and accuracy of placement of the HRM catheter. It is also important to consider ambulatory pH/impedance testing in the majority of patients undergoing HRM as data from both studies, along with swallowing fluoroscopy and esophagoscopy, provide essential data needed to develop a comprehensive and personalized plan of care.
- b. Method:
  - a. HRM following the CC v3.0 is based upon data collected from ten 5mL saline water swallows. Patients undergoing HRM are asked to fast for 6 hours prior to the procedure to reduce the volume of emesis should the patient experience this during catheter placement. If achalasia is expected, placing the patient on a liquid diet or having nothing by mouth for 12 hours prior to the procedure by be needed. Patients are also instructed that they should refrain from using any medications that can impact esophageal motility.
- c. Interpretation:
  - a. CC v3.0 Esophageal motility disorders are as follows:
    - i. Achalasia – (Type 1, Type 2, & Type 3)
    - ii. Esophagogastric Junction Outlet Obstruction (EGJOO)
    - iii. Jackhammer Esophagus (JHE)
    - iv. Distal esophageal spasm (DES)
    - v. Esophageal Aperistalsis (EA)
    - vi. Ineffective esophageal motility (IEM)
    - vii. Fragmented peristalsis (FP)

### **Pathophysiology:**

- a. Background:
  - a. In the 1990's a new form of esophageal manometry was introduced by Clouse et. al. utilizing esophageal pressure tracings from 21 pressure sensors placed along the esophageal body at ~1 cm apart on a water-profused motility catheter system.<sup>5</sup> Today, HRM may utilize up to 36 circumferential high-fidelity solid-state sensors that are place into a flexible catheter which then give topographical contour plots of esophageal contractility events.<sup>6</sup> Further advances to HRM consist of the addition of electrode pairs to the motility catheter for concurrent impedance measurements to gauge bolus transit.
- b. Scientific Premise:
  - a. When comparing HRM to conventional manometry there are two basic advances.
    - i. First, HRM has an increased number of pressure data points to provide a detailed inspection of esophageal pressure to allow detection of subtle changes in motility.<sup>7</sup>
    - ii. Second, HRM provides a greater understanding of special and temporal connections between pressure data points by three-dimensional plotting and interpolation of data. Combining this pressure data with multichannel impedance measurements, understanding of esophageal physiology and pathophysiology has been greatly enhanced.
- c. Indications/Contraindications:



- a. Indications: The most common indication for HRM is to evaluate esophageal motility when reflux surgery is being considered (i.e. Nissen fundoplication). Other indications for HRM include the comprehensive work-up of dysphagia and esophageal motility disorders in the absence of inflammatory/obstructive pathology on endoscopy/esophageal fluoroscopy, atypical chest pain (after a full cardiac workup has been completed and deemed normal), incomplete response to reflux surgery and/or bariatric surgery, and if there are complications following reflux and/or bariatric surgery. Expanded indications include therapeutic uses for oropharyngeal swallowing dysfunction.
- d. Risks/Possible Complications:
  - a. HRM is relatively safe if appropriate pre-procedure testing is done including esophageal fluoroscopy/endoscopy. Patients may experience mild discomfort including gagging, vomiting, coughing, watery eyes, gagging, irritation of the nose and throat. Potential rare but serious complications include nosebleed, aspiration, pneumonia, infection, esophageal injury, cardiac arrhythmia, or esophageal perforation.

#### References:

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