Esophageal Motor Function

Technical Aspects of Manometry

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KEYWORDS

• High-resolution manometry • Clouse plot • Esophageal motor function • Dysphagia

KEY POINTS

- High-resolution manometry (HRM) affords easier identification of anatomic landmarks and esophageal motor patterns, shorter duration of procedures, uniform analysis parameters, and better comprehension for learners in comparison with conventional manometry.
- HRM is used to evaluate esophageal motor function in patients with esophageal symptoms unexplained after endoscopy or contrast studies, to assess esophageal peristalsis before foregut surgery, and to localize the lower esophageal sphincter (LES) for placement of pH and pH-impedance catheters.
- Aberrancies in catheter positioning, such as failure to traverse the LES or the diaphragm, and equipment-related artifacts, such as thermal drift or sensor malfunction, should be recognized and rectified appropriately.
- The technician performing the HRM study needs to be able to reassure the patient, identify esophageal landmarks and motor patterns, understand critical and noncritical imperfections, and modify the study accordingly.

INTRODUCTION

Esophageal manometry consists of measurement of pressure events in the esophagus following test swallows, represented as timing and amplitude of pressure events.[1] Esophageal intraluminal pressures are converted to an electrical signal that can be recorded, amplified, and displayed as pressure tracings at each recording location along the esophagus. Initial conventional manometry systems consisted of an array of unidirectional recording sites distributed at predefined locations along the length of a catheter placed in the esophageal lumen. Line tracings of pressure events were displayed in a stacked format from proximal to distal esophagus, and proximal stomach. The characteristics of the pressure events designated whether

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the esophageal body, an esophageal sphincter, or the gastric baseline was addressed by each recording site.[1]

High-resolution manometry (HRM) represents a paradigm shift from conventional manometry in that multiple circumferential pressure sensors are used and topographic plots of esophageal pressure data are generated. These plots can be viewed as colored contour maps on which each color represents a pressure value. The close spacing of sensors allows better sampling of esophageal intraluminal pressures as a continuum throughout the esophagus and its sphincters, rather than as point samples at predefined distances as used with conventional manometry.[2,3] Computerized software programs fill points in between pressure recordings with best-fit data to create smooth color-contour plots of esophageal peristalsis, now uniformly termed Clouse plots in honor of Ray Clouse who pioneered the technology (**Fig. 1**).[2,4] Advantages of HRM over conventional manometry include easier identification of anatomic landmarks, shorter duration of data acquisition, more specific assessment of sphincter function, and easier recognition of motor patterns.[1]

INDICATIONS AND CONTRAINDICATIONS

HRM represents the test of choice to evaluate esophageal motor function. The primary value of HRM remains the identification of esophageal outflow obstruction from a motor process such as achalasia. The benefit stems primarily from the fact that software tools have been designed to extract nadir pressures during expected lower esophageal sphincter (LES) relaxation during a test swallow. Of these, the integrated relaxation pressure (IRP), which extracts 4 seconds of continuous or discontinuous nadir pressure, performs the best.[5] The sensitivity of IRP as an HRM tool for the diagnosis of achalasia has been well documented in comparisons with point-pressure sensors

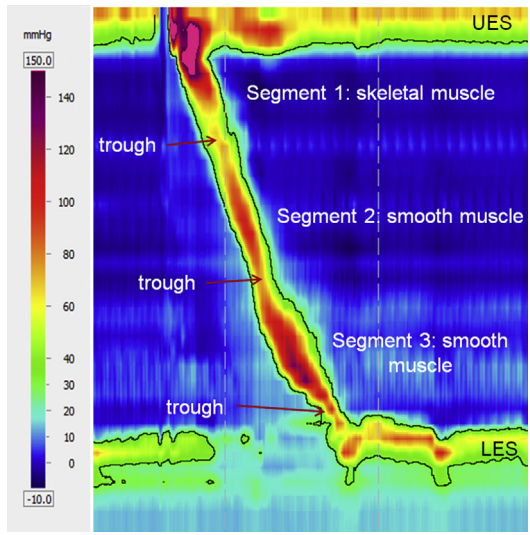

Fig. 1. Clouse plot showing a normal peristaltic sequence following a test swallow. The x-axis represents time, the y-axis represents length along the esophagus, and contraction amplitudes are depicted as color contours, with warmer colors representing higher amplitudes. High-resolution manometry has demonstrated esophageal peristalsis to consist of a chain of relaxing sphincters (LES, lower esophageal sphincter; UES, upper esophageal sphincter) and contracting segments (segment 1: skeletal muscle; segments 2 and 3: smooth muscle), separated by pressure troughs.