

Ambulatory Esophageal pH Monitoring



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KEYWORDS

- Esophageal pH monitoring • Gastroesophageal reflux disease • Catheter-based
- Wireless-based • Impedance

KEY POINTS

- Physicians should have a general knowledge of the diagnostic accuracy of each pH monitoring method.
- Prolonged pH monitoring and the combined impedance function increase the amount of information available for esophageal acid exposure evaluation; however, their effects on gastroesophageal reflux disease (GERD) diagnosis and clinical management are still under ongoing investigation.
- Prolonged pH monitoring increases the reflux detection rate.
- Because of the complexity of GERD diagnosis, routine pH monitoring should be performed for patients who are undergoing evaluation for antireflux surgery.

INTRODUCTION

The first link between gastric acid and gastroesophageal reflux (GER) was reported in 1884 after the retrieval of an acid-contained sponge from the esophagus of a patient with heartburn. The association between esophageal mucosal damage and the presence of acidic juice in the esophagus slowly emerged over the early part of the twentieth century. In 1958, Tuttle and Grossman^{1,2} first measured esophageal acid reflux using an existing gastric pH meter with manometry. Johnson and DeMeester¹ established the foundation of esophageal pH monitoring in 1974 after studying GER in normal subjects and patients with reflux symptoms. In this landmark study, not only the methodology of esophageal pH monitoring and the normal reference values were defined but also a composite scoring system, the DeMeester score, was created to quantify acid exposure using 6 pH parameters.¹ This scoring system has been widely validated and is used today. With the advancement of technology, the sponge was replaced by glass and then antimony electrode catheters and in the 1990s to a

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wireless implantable capsule; but the concept of esophageal pH monitoring for the evaluation of GER disease (GERD) has not changed over the past hundred years. The aims of this article are to review the current methods of ambulatory esophageal pH monitoring, compare the advantage and disadvantage of each test, and to discuss current controversies of each method in an effort to elucidate future directions in the diagnosis of GERD.

ESOPHAGEAL pH MONITORING: WHAT, WHY, AND WHEN

Esophageal pH monitoring is a direct *in vivo* measurement of esophageal acid exposure over time for the evaluation of GERD. It can be currently performed using either catheter-based or wireless systems (Fig. 1). Catheter-based pH monitoring requires transnasal placement of the catheter, with its measuring electrode located 5 cm above the manometrically measured upper border of lower esophageal sphincter (LES). A wireless-based pH capsule is generally placed endoscopically, 6 cm above the squamocolumnar junction (SCJ), or in the setting of Barrett esophagus above the top of the gastric rugal folds. The pH recordings of 24 hours, 48 hours, or 96 hours are currently possible, depending on the choice of device (catheter vs wireless), patient tolerability, and the duration a capsule remains attached. In the case of wireless monitoring, the pH data (sampled at a frequency of once every 6 seconds) are transmitted to an external radiofrequency recorder and then transferred to a computer with commercial software allowing automatic and/or manual analysis. Patients are generally asked to keep a diary recording symptoms, body positions, and meal periods during the time of pH monitoring allowing the analysis of reflux patterns and symptom correlation measures. Fig. 2 demonstrates the basic steps of the test. Currently available and widely used pH monitoring options are listed in Box 1.

Esophageal pH monitoring is a crucial part of GERD evaluation. According to the 2007 American College of Gastroenterology's practice guidelines for esophageal reflux testing, pH monitoring

1. Is useful in documenting abnormal esophageal reflux exposure in endoscopy-negative patients with typical reflux symptoms who failed medical therapy and are being considered for antireflux surgery

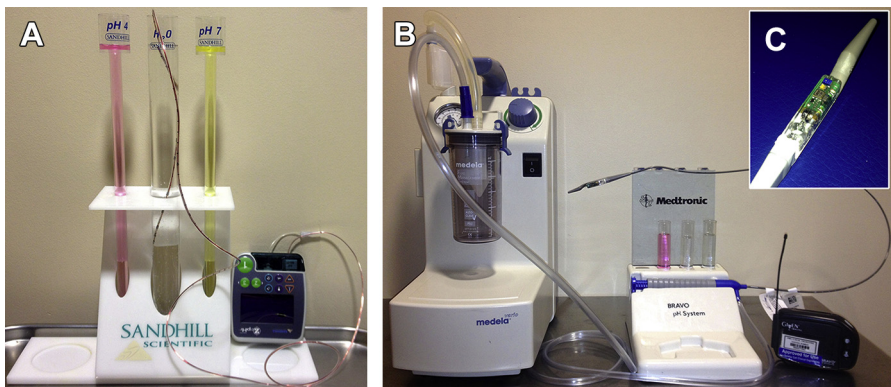


Fig. 1. Ambulatory esophageal pH monitoring: catheter-based (A) or wireless-based device (B; Bravo, Given Imaging Ltd, Yoqneam, Israel). The Bravo capsule (C) is loaded on the delivery system. (Images used with permission from Medtronic, Minneapolis, MN; Sandhill Scientific, Highlands Ranch, CO; Medela Inc, McHenry, IL; and Given Imaging, a Covidien company. The use of any Covidien photo or image does not imply Covidien review or endorsement of any article or publication.)

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