pH studies: Clinical indications

RPE Reynolds MD FRCPC

Ambulatory 24 h esophageal pH monitoring is the standard for establishing the presence of a pathological degree of acid reflux. The calibrated pH probe is passed through the nose and positioned in the distal esophagus. The probe is connected to a battery-powered data collector, which is usually worn with a shoulder strap. By altering the position of the recording device (vertical or horizontal), the machine can record acid reflux episodes as occurring in either the upright or recumbent position. Meals and symptoms are recorded by pushing event marker buttons on the data recorder. A relatively normal diet can be consumed during the 24 h study but acidic foods and beverages (ie, citrus fruits and juices, soft drinks, clear tea and pickled foods) must be avoided.

Although 24 h pH monitoring was introduced to clinical gastroenterology more than 30 years ago (1-3), it is still not widely available in Canada. The use of this diagnostic tool may have been influenced by the availability of esophageal manometry, which seems to be waning, but remains the most accurate method of placing the esophageal pH probes. The single distal pH electrode placed 5 cm above the manometrically determined lower esophageal sphincter (LES) is still the reference standard for pH studies. A cynic might cite the low professional fee (\$39.80 in Ontario) as the reason for the lack of interest among gastroenterologists in Canada, but perhaps the availability of potent proton pump inhibitors (PPIs), allowing diagnostic and therapeutic trials of acid suppression, has decreased the need for the recording technique. Ambulatory 24 h pH studies are expensive with single-use transnasal electrode probes (\$75 per probe added to the initial costs of the recording and analyzing equipment, plus the cost of manometry for placement) and are somewhat uncomfortable for the patient. Newer technologies, such as the Bravo wireless pH monitoring system (Medtronic Inc, USA) (4), improve patient comfort but significantly increase the cost (US\$225 per capsule plus US\$6,900 for the receiver plus the cost of endoscopy for placement). Patients are generally able to maintain a more normal diet and level of activity with the wireless system.

Ambulatory esophageal pH monitoring has been considered the 'gold standard' diagnostic test for acid reflux in the past but it is now clear that in patients with normal endoscopy, the sensitivity may be as low as 60% and the specificity only in the 85% to 90% range (5). The problem lies with establishing

an optimum definition of a 'pathological' degree of acid reflux. Many of the diagnostic criteria were established in patients with endoscopic evidence of reflux esophagitis, and hence, represented only a portion of the spectrum of reflux patients.

Acid reflux episodes are defined as a drop in pH below 4 at a point 5 cm above the LES. The total time over a period of 24 h that the pH is below this threshold is the most reproducible measure of a pathological degree of acid reflux, but many other criteria are also employed. Symptoms may also occur when the pH only drops to 4.5 in the distal esophagus or perhaps when sufficient acid only refluxes 4 cm above the LES. This has led to a poor correlation between measures of acid reflux, such as the often quoted DeMeester score (2) (a composite of a number of factors that evaluate acid reflux, including the percentage of time that the pH is below 4; total reflux, upright reflux and recumbent reflux; number of episodes; number of episodes longer than 5 min; and the longest

episode), and reflux-related symptoms or response to acid suppression.

In addition to quantifying acid reflux, 24 h pH monitoring also provides the opportunity to assess the relationship between symptoms and episodes of acid reflux. This feature has largely eliminated the need for Bernstein acid perfusion tests in most centres. Patients record the onset of different symptoms by pushing appropriate markers on the recording device. A positive correlation between symptoms and acid reflux is usually defined by more than 50% to 70% of symptoms occurring within 2 min to 5 min of an episode of acid reflux, but a variety of statistical analyses have been developed in an attempt to improve the temporal correlation (6,7). Few studies have shown the utility of any of these indices in predicting response to treatment, which is one of the reasons that therapeutic trials with double-dose PPIs have displaced pH monitoring as the most useful tool in the initial assessment of typical and extraesophageal reflux symptoms (8).

The indications for 24 h pH monitoring usually involve diagnostic uncertainty. There is no value in performing the study in patients with classical symptoms unless they are not responding to optimum therapy, nor is it useful in patients with endoscopy-positive gastroesophageal reflux disease. Ambulatory pH monitoring is helpful when documenting a pathological degree of acid reflux in endoscopy-negative patients who are being considered for surgical intervention. Some surgeons

Dr RPE Reynolds

Department of Medicine, The University of Western Ontario, London, Ontario

Correspondence: Dr RPE Reynolds, Department of Medicine, St Joseph's Health Care, 268 Grosvenor Street, London, Ontario N6A 4V2.

Telephone 519-646-6100 ext 64698, fax 519-646-6130, e-mail rper@uwo.ca

prefer to have preoperative 24 h pH results of all patients to use as a baseline, in case symptoms persist following a fundoplication which, unfortunately, is not an infrequent event. The second main indication for 24 h pH monitoring is in the assessment of atypical symptoms such as cough, hoarseness, sore throat, atypical chest pain and asthma usually following a failed or incomplete response to a therapeutic trial of double-dose PPI (9). In the assessment of extraesophageal reflux symptoms, a dual electrode pH probe is sometimes useful. In this situation, reflux into the proximal esophagus can be simultaneously monitored, which may provide evidence regarding the likelihood of esophagopharyngeal reflux. Dual probes can also be used to monitor the pH in the pharynx (10). Demonstrating a correlation between the timing of acid reflux events and the onset of extraesophageal symptoms does not prove a causal association, however (11). 24 h pH monitoring can be useful when assessing patients with refractory symptoms and, in that case, the study may be performed with the patient taking their usual dose of a PPI (12). Symptom correlation is particularly helpful in this setting. If symptoms persist despite virtually complete obliteration of acid reflux with PPI therapy, then the diagnosis of gastroesophageal reflux disease should be seriously questioned. On the other hand, this type of study may confirm the presence of 'refractory' acid reflux and indicate the need for extraordinary doses of a PPI or surgical intervention.

Problems associated with 24 h pH monitoring are multiple, and include limitations on the patient's ability to eat and perform regular activities because of discomfort, equipment failure, probe migration over the course of the study and poor intra-subject reproducibility with repeat studies. Some of these problems have been solved with the Bravo wireless pH monitoring system, but it comes with its own set of complications including chest discomfort, electrode displacement and, occasionally, more serious complications (5). Bravo capsules permit 48 h monitoring and there is evidence that the extra 24 h of evaluation increases the sensitivity of the test (13). Although the Bravo system of pH monitoring is better tolerated by patients (14), cost considerations will limit its utilization in Canada.

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