

Detection of Acid, Weakly Acidic and Gas Reflux

a report by

Sara Emerenziani and Daniel Sifrim

Resident in Gastroenterology and Endoscopy, Policlinico Tor Vergata, and Professor of Medicine, Centre for Gastroenterological Research, Catholic University of Leuven



Sara Emerenziani is a Resident in Gastroenterology and Endoscopy at Policlinico Tor Vergata in Rome. She is also a member of the Italian Gastroenterology Society. Dr Emerenziani was a research fellow at the Catholic University of Leuven under the direction of Professor Daniel Sifrim. Her clinical and research interests are in pathophysiology of gastro-oesophageal reflux disease and oesophageal motility disorders. She graduated as MD at University Campus Bio Medico.

Daniel Sifrim is Professor of Medicine at the University of Leuven. He is also a member of the Center for Gastroenterological Research KU Leuven. In recent years, Dr Sifrim has been devoted to the development of new techniques to measure gastro-oesophageal reflux and oesophageal motility. He serves as a reviewer for most of the major gastroenterology journals and has authored or co-authored more than 40 original articles, book chapters and reviews on these topics. Dr Sifrim obtained his PhD degree at the University of Leuven in 1994 and graduated as MD in 1979 at the University of Buenos Aires.

The role of acid has been well established in the pathophysiology of gastro-oesophageal reflux disease (GORD). Studies have demonstrated that acid reflux plays a major role in eliciting symptoms and mucosal damage. However, acid reflux is not the only determinant of GORD symptoms. It is now recognised that a subgroup of patients with GORD may be refractory to acid-suppressive therapy, suggesting that other factors in the oesophagus or the refluxate may play an additional role in the pathogenesis of GORD symptoms. Moreover, patients with non-erosive gastro-oesophageal reflux disease (NERD) account for up to 70% of the total population of GORD and 30% to 50% of these patients may have normal oesophageal acid exposure in spite of deterioration of their quality of life similar to that observed in patients with oesophagitis.

To date, most concepts about gastro-oesophageal reflux have been based on inferences derived from measurement of oesophageal pH. However, pH monitoring does not detect all gastro-oesophageal reflux events. This is the case in both adults and infants after eating (but before the gastric contents have become acidified) and it applies to reflux in patients undergoing antisecretory therapy.

Other methodologies have evolved to complement ambulatory pH monitoring for detection and characterisation of gastro-oesophageal reflux. For example, intraluminal electrical impedance offers the potential to detect and monitor liquid or air movements within the oesophageal lumen in a pH-independent manner. This article focuses on the detection of acid, weakly acidic and gas reflux and their relationship with symptoms and disease complication.

Acid Reflux

Heartburn and regurgitation are considered to be the key symptoms after acid reflux and can be assessed by dedicated questionnaires. When present as predominant symptoms, they are specific of GORD but are rather insensitive. Bernstein's oesophageal acid perfusion test determines whether chest pain or heartburn is secondary to increased oesophageal sensitivity to acid. However, it is

positive in 5% to 15% of healthy volunteers and in patients with duodenal ulcer and gastritis. Ambulatory 24-hour pH monitoring is considered the gold standard for acid reflux detection. Through this test, excessive reflux can be identified and, more importantly, a temporal relationship between a patient's symptoms and acid reflux episodes can be demonstrated. In general, patients with oesophagitis were found to have a higher oesophageal acid exposure time (AET) than healthy subjects and GORD patients without oesophageal lesions. However, the correlation between acid exposure and symptoms or severity of oesophageal mucosal damage is still far from clear. Recently, Jung et al. failed to find a correlation between acid sensitivity detected by pH monitoring and acid sensitivity detected by Bernstein testing.

Currently, three different indices are used to investigate the relationship between symptoms and acid reflux:

- the symptom index (SI);
- the symptom sensitivity index (SSI); and
- the symptom association probability (SAP).

Recently, the SAP and SSI have been shown to be significantly related to symptomatic response to high-dose omeprazole, but the presence of a significant number of discordant cases – i.e. positive SAP with negative response to proton pump inhibitors (PPIs) – suggests that these indices are still sub-optimal predictors of response to anti-reflux therapy.

A wireless pH-metry system has recently been developed. Pandolfino et al. assessed the acid exposure with this wireless pH recording system in healthy subjects and patients with GORD. Most of the control subjects and GORD patients had recordings for two consecutive days, offering the opportunity to examine day-to-day variability in oesophageal acid exposure values and to see whether an extended recording period improved the power of the test to discriminate the GORD population from normal. The results showed the added diagnostic yield of the extended recording period. In fact, 12 GORD patients and seven

control subjects had a normal oesophageal acid exposure value on the first day and an abnormal exposure on the second day. Half of these were abnormal on both day one and day two. Moreover, the wireless pH monitoring system may be of benefit as the extended 48-hour monitoring period would increase the likelihood of documenting relationship between typical and atypical symptoms and reflux events.

Multiple pH-metry has been used to assess velocity and proximal spreading of acid reflux. Perception of reflux symptoms might depend on the proximal extent of the refluxate. More reflux events have a longer distal duration and reach a higher proximal level in patients with GORD than in normal controls. Particularly interesting are the increased rate and perception of proximal reflux in NERD patients with otherwise normal distal acid exposure.

Oesophageal pH is conventionally recorded at 5cm above the lower oesophageal sphincter. However, the mucosal changes of reflux oesophagitis and intestinal metaplasia tend to affect the segment close to the squamocolumnar junction. Distal pH-metry was recently used to assess acid exposure close to the squamocolumnar junction using metal clips to secure the pH catheter to the oesophageal mucosa. The number of acid reflux events and acid exposure at 0.5cm above the squamocolumnar junction is five to 10 times higher than 5cm more proximally.

The PPI test consists of monitoring the symptomatic response to a PPI given in a large dose for a brief period. The test is considered positive when a 50% to 75% improvement of symptoms is observed. It should be noted that approximately 20% of the patients with GORD showed a 50% improvement of symptoms during placebo. In general, the PPI test had a high sensitivity for the diagnosis GORD – defined as pathological AET, the presence of oesophagitis on endoscopy, a good correlation between symptoms and acid reflux during pH monitoring or a combination of these. The specificity, however, was disappointingly low.

Weakly Acidic Reflux

Intraluminal impedance allows detection of gastro-oesophageal reflux based on changes in resistance to electrical current flow between two electrodes, when a liquid and/or gas bolus moves between them. The impedance will decrease if a highly conductive bolus such as saliva reaches the oesophagus, whilst it will increase if a poorly conductive material such as air enters the oesophageal lumen. The sequence of impedance changes in different segments allows recognition of flow either in aboral (swallow-related) or oral

(reflux) directions. Impedance has a sensitivity of at least 90% for detection of all reflux episodes (pH-independent) but it does not measure acidity of the intraluminal content. The use of combined pH monitoring and impedance permits the most accurate detection of reflux episodes.

The term ‘non-acid reflux’ has been used to refer to:

- reflux episodes diagnosed by manometry or scintigraphy without pH drops across 4;
- duodenogastro-oesophageal reflux events (DGER) diagnosed with Bilitec monitoring;
- reflux events diagnosed by impedance monitoring with no change in pH or a pH drop that does not reach 4; and
- reflux events diagnosed by impedance monitoring with no change in pH or a pH drop of less than one pH unit.

A recent international workshop involving GORD experts critically reviewed and discussed the performance of the various tools available for detection of gastro-oesophageal reflux and proposed consensus-based definitions of acid, non-acid and gas reflux, applicable to both adult and paediatric populations.

Based on oesophageal pH during reflux detected by impedance monitoring, three categories of reflux were proposed:

- Acid reflux is defined as ‘reflux episodes that decrease oesophageal pH across 4, or reflux that occurs when oesophageal pH is already below 4’. The occurrence of reflux episodes when the basal oesophageal pH is already below 4 represent a sub-category of acid reflux called superimposed acid reflux. This is an important phenomenon underlying the delay in oesophageal clearance, particularly in patients with hiatal hernia.
- All reflux episodes in which the nadir pH lies between 4 and 7 are called ‘weakly acidic reflux’. The upper limit of pH 7 was chosen to define the limit of weakly acidic events, as any fall below pH 7 contains some acid.
- The term ‘weakly alkaline reflux’ should be reserved for reflux episodes detected by impedance monitoring during which nadir oesophageal pH does not drop below 7. ■

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