

Richard W. McCallum, MD, FACP, FRACP (Aust), FACG, AGAF

## Belching, Aerophagia and Rumination: Not Just Refractory Gastroesophageal Reflux Disease



Il J. Paik



Craig R. Gluckman

**W**idespread availability and utilization of esophageal impedance recording and pH monitoring in specialized motility centers has improved our understanding of belching, aerophagia and rumination. This new understanding has increased our ability to diagnose and differentiate patients with these and other related conditions. As the pathophysiology of these heterogeneous group of disorders becomes clearer, our ability to treat often closely related entities continues to improve. This benefits patients, who have often gone undiagnosed or incorrectly labelled, as well as the primary care doctors and gastroenterologists caring for these patients. Impedance studies, differentiating and diagnosing these very different conditions, has improved our understanding of gastroesophageal reflux (GERD) and its relationship to these disorders.

Il J. Paik, MD, Assistant Professor of Medicine-Gastroenterology, Icahn School of Medicine at Mt Sinai. Director, Swallowing Center of the Mt Sinai Health System Digestive Disease Institute Director, Center for GI and Motility Disorders. Mt Sinai St Luke's and Mt Sinai West Hospitals. Craig R. Gluckman, MBBCh, Gastroenterology Fellow, Mount Sinai Beth Israel, New York, NY

High-resolution manometry and impedance studies have allowed physicians to now more confidently identify subtle differences between belching, aerophagia and rumination resulting in the correct treatment options being applied to these patients.

### **BELCHING** **Introduction**

Excessive belching has become one of the most common chief complaints that physicians address. Patients often present after an unremarkable endoscopic evaluation and clinical failure on multiple regimens of proton pump inhibitors (PPIs) and other acid-suppressing medicines. Historically, the diagnosis of excessive belching required a careful history and close observation during physical examination. Patients often describe a variety of symptoms and sensations to explain the act of belching as a primary symptom or in association with other upper gastrointestinal symptoms. This has led to a discrepancy between the subjective symptoms described by the patient and the ability of the clinician to make an objective diagnosis. An incomplete understanding of the pathophysiology of belching, aerophagia and rumination and the lack of diagnostic tests may have led to this discrepancy.

Currently, newer esophageal impedance testing now allows more accurate differentiation between these various conditions. Specifically, differentiating between various types of belching and correctly identifying it as an isolated condition or as a concomitant symptom in patients with GERD or functional dyspepsia is possible. This testing allows clinicians to improve their evaluation of patients with symptoms such as dysphagia, epigastric pain, persistent reflux and heartburn.

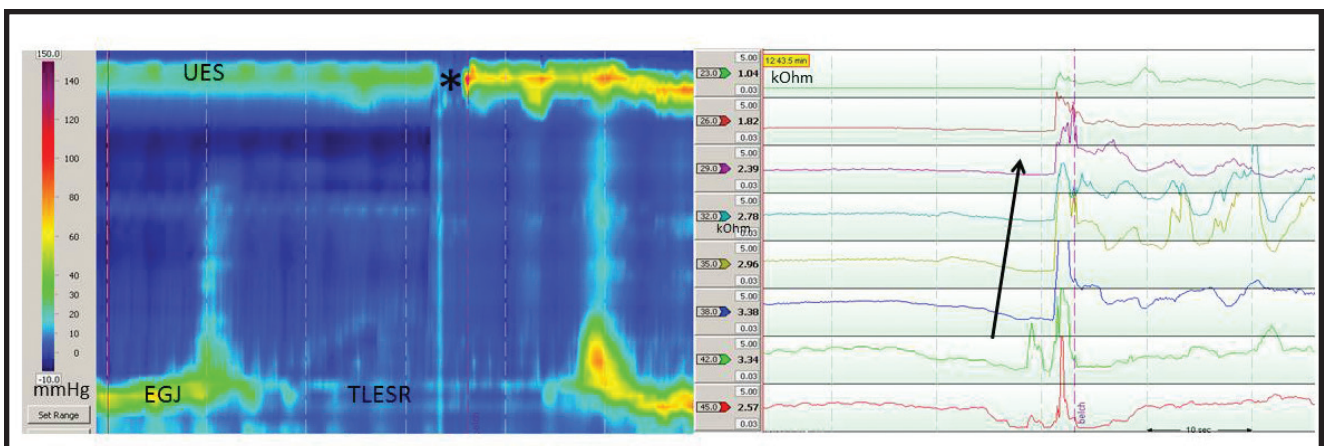
Belching (eructation) is the oral expulsion of a gas bolus from the upper gastrointestinal tract; this release can be audible or occur silently.<sup>1</sup> Gases, a normal constituent of the gastrointestinal tract, enter the esophagus and moves to the stomach with each swallow. Gases can also be released in the stomach by ingested food and drink. In the small intestines and colon, gases are produced by bacterial fermentation of luminal contents. These gases are released from the gastrointestinal tract proximally in the form of a belch and distally as flatus.<sup>2</sup>

Many patients with belching may not initially present to a healthcare provider. However, patients are likely to seek attention if their belching is responsible for a decreased quality of life or at the request of friends, family or co-workers. Patients with GERD and functional dyspepsia frequently complain of belching, but other symptoms usually predominate. Studies show

that an excess of air swallowing and belching in these patients is a response to uncomfortable gastrointestinal sensations.<sup>3</sup> Treatment with a PPI reduces the number of air swallows in patients with GERD but not in other subjects, which suggests that the unpleasant sensation of heartburn stimulates patients to swallow more air.<sup>4</sup> So, belching is the physiological venting of excessive gastric air.<sup>5</sup>

### Pathophysiology of Belching

The mechanism of belching has further been elucidated through the use of manometric studies and esophageal electrical impedance monitoring. (Figure 1) Air and saliva are pushed down through the esophagus into the stomach by peristalsis as the lower esophageal sphincter (LES) relaxes. Gastric air causes dilation of the proximal stomach and activates a vaso-vagal reflex. A belch begins with a transient lower esophageal relaxation (TLESR) triggered by distension of the fundus from this intragastric air and movement of air begins from the stomach into the distal esophagus. This is then followed by reflex relaxation of the upper esophageal sphincter (UES) as air moves up towards the proximal esophagus and then expelled orally. This physiological response of venting excessive gastric air is what the patient will perceive as a belch. This gastric belch reflex releases the uncomfortable sensation associated



**Figure 1. Gastric Belch**

**Left:** HRM with concomitant impedance test showing a TLESR event with a gastric belch; prolonged LES relaxation in the absence of a prior swallow with inhibition of crural diaphragm (TLESR) and opening of the upper esophageal sphincter (\*) to produce a gastric belch.

**Right:** concomitant impedance test showing rapid gas movement from the stomach to the hypopharynx (arrow). Gas has a high impedance and liquid has low impedance signal.

HRM: High Resolution Esophageal Manometry; EGJ: Esophagogastric junction; TLESR: transient lower esophageal sphincter relaxation; UES: upper esophageal sphincter

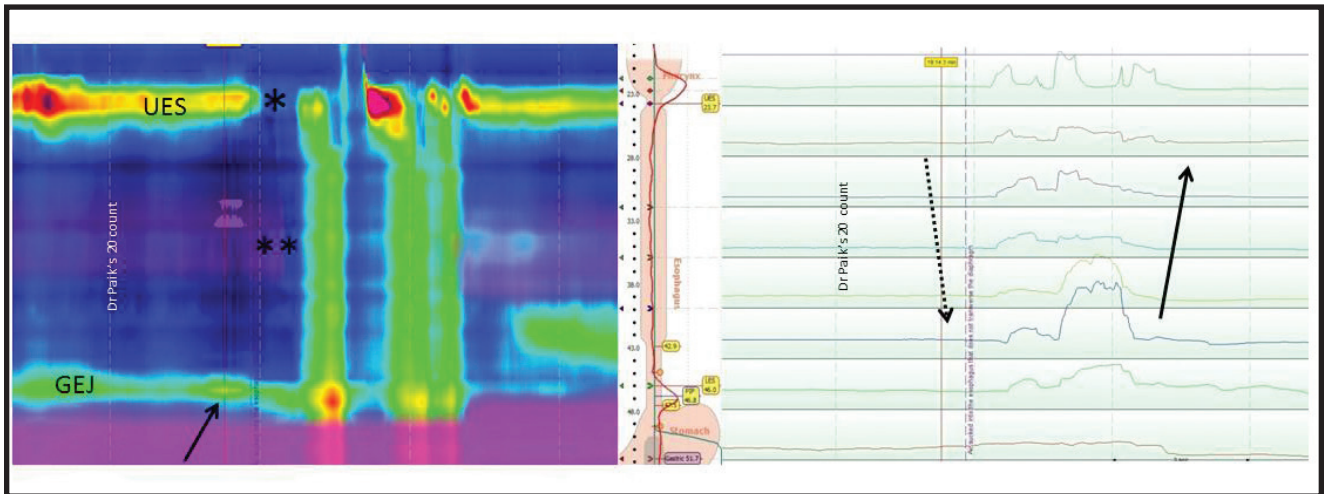
with gastric distension and is the gaseous equivalent of gastroesophageal reflux as both occur in the setting of a spontaneous and not swallow-induced TLESR. This gastric belch reflex is lost following a fundoplication procedure done for anti-reflux surgery as the ability for proximal stomach distension and TLESR are decreased. These patients are physically unable to belch and are often left with the uncomfortable sensations of bloating, flatulence and abdominal distension<sup>6</sup>, often referred to as the post-fundoplication gas-bloat syndrome.

This gastric belch needs to be differentiated from a second type of belch identified in patients with isolated excessive belching. Initially detected in the 1990s with the use of intraluminal esophageal impedance monitoring of the flow of fluid and air in the esophagus, a new mechanism of belching was described. Now known as a supragastric belch, this second type of belching, which is physiologically different from a gastric belch, is characterized by air rapidly brought into the esophagus and immediate, rapid, oral expulsion without ever reaching the stomach. Combined use of high resolution manometry and impedance monitoring has discovered that this belch may be initiated by air

which is sucked into the esophagus by creating a negative intrathoracic pressure or less commonly by pushed or injected air from an increase in pharyngeal pressures.<sup>7</sup> This also identified patients with repetitive and multiple, instantaneous supragastric belches as only occurring in patients with supragastric belches and not with gastric belches.<sup>8</sup>

Impedance studies, with or without manometry, can now accurately differentiate patients with gastric belching from supragastric belching and other mimickers. From these studies, a supragastric belch has been defined as a rapid anterograde movement of gas (impedance >1000Ω), followed by its quick retrograde expulsion with a return to baseline impedance. (Figure 2) The incidence of air-containing swallows and gastric belches is similar in patients and controls but supragastric belches occur exclusively in affected patients.<sup>9</sup>

Initially a supragastric belch represents a voluntary response to an unpleasant gastrointestinal sensation, but over time patients may no longer be aware that their belches are under voluntary control, thus becoming excessive and repetitive. Supragastric belches almost



**Figure 2. Supragastric Belch**

The patient sucks in air that does not reach the stomach and immediately expels it back and repeats the behavior.

**Left:** The manometry shows opening of the UES (\*) with simultaneous increase of pressure at the GEJ (arrow) and associated lowering of the intrathoracic pressure (\*\*) followed by a pressure wave in the esophagus with associated gas expulsion. Note the lack of retrograde movement of the liquid present in the stomach (purple).

**Right:** The concomitant impedance test shows aboral esophageal air movement (dashed arrow) that does not enter the stomach and then it is expelled immediately (solid arrow).

During a high-resolution manometry with concomitant impedance test, the patient was instructed to perform Dr. Paik's 20 count; the patient in a sitting up position was instructed to count to 20 out loud and swallow at will.

Gas has a high impedance and liquid has low impedance. The purple color represents liquid signal.

HRM: High Resolution Esophageal Manometry; EGJ: Esophago-gastric junction; UES: upper esophageal sphincter



always cease at night suggesting the presence of a behavioral disorder.<sup>10</sup> Additional studies have shown that patients with excessive belching who were unaware that they were being studied or were distracted during the study had significantly reduced numbers of belches.<sup>11</sup> Typically, a patient belches while the physician is asking the questions, whereas a patient does not belch while responding to these questions.<sup>12</sup> These studies support the rationale for behavioral therapy as a method of treatment.

The estimated prevalence of supragastric belching in a tertiary referral population is 3.4% in patients being investigated with upper gastrointestinal symptoms.<sup>13</sup> Not all patients diagnosed with supragastric belching report belching as their predominant symptom and, conversely, many patients who report excessive belching are not in fact belching by current manometric criteria.

Patients with esophageal hypomotility on high resolution manometry demonstrate an increase in the frequency of supragastric belching compared to the patients with normal motility.<sup>14</sup> It is unclear whether the hypomotility led to supragastric belching or if some factor in patients with supragastric belching

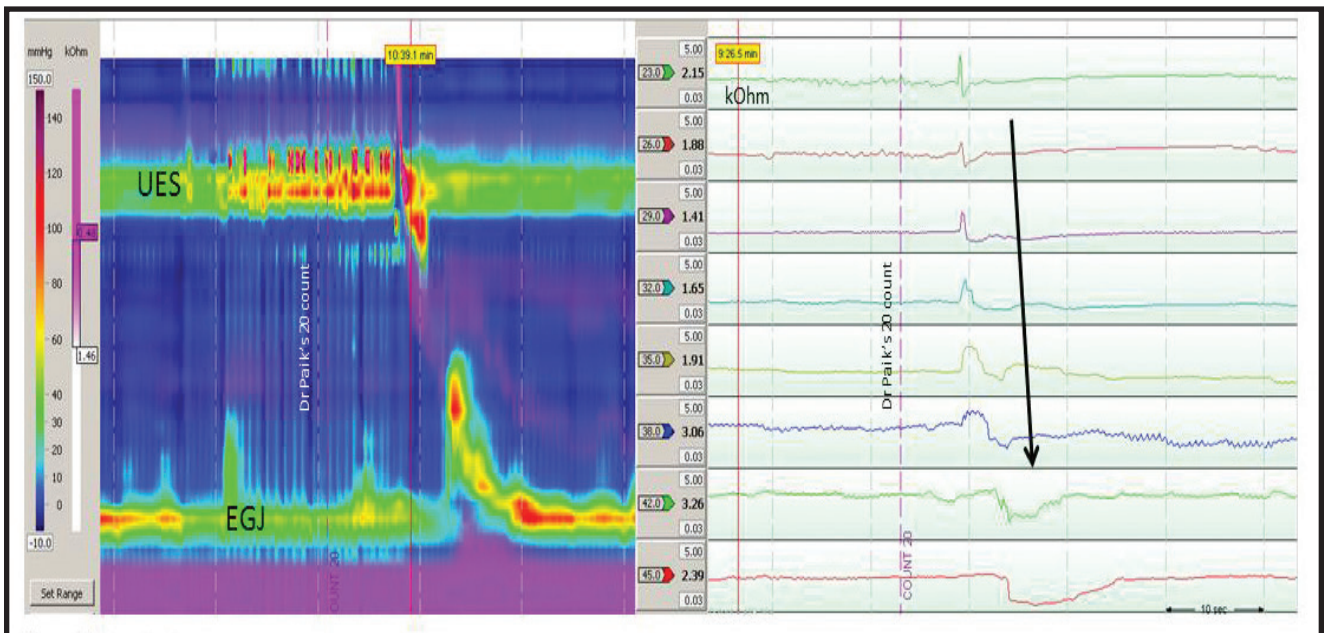
affected motility patterns. Further studies are needed to investigate this possible association.

### Belching in Patients with GERD

Estimates of 40-49% of patients with GERD experience belching.<sup>15</sup> Air swallowing promotes belching but does not facilitate acid reflux.<sup>16</sup> Similarly, supragastric belching was more frequent in patients with typical reflux symptoms than in healthy subjects. Supragastric belches occur immediately prior (<1s) to the onset of the reflux episode suggesting that the supragastric belching occurs in response to the unpleasant sensation felt in those with reflux.<sup>17</sup> Patients with severe reflux symptoms have more supragastric belching and subsequently more severe belching complaints. Thus, it has been suggested that GERD patients with troublesome belching symptoms could also be treated with speech therapy aimed at reducing the incidence of supragastric belches.<sup>18</sup>

### Treatment of Belching

Supragastric belching is associated with significant reduction in quality of life and distressing psychosocial

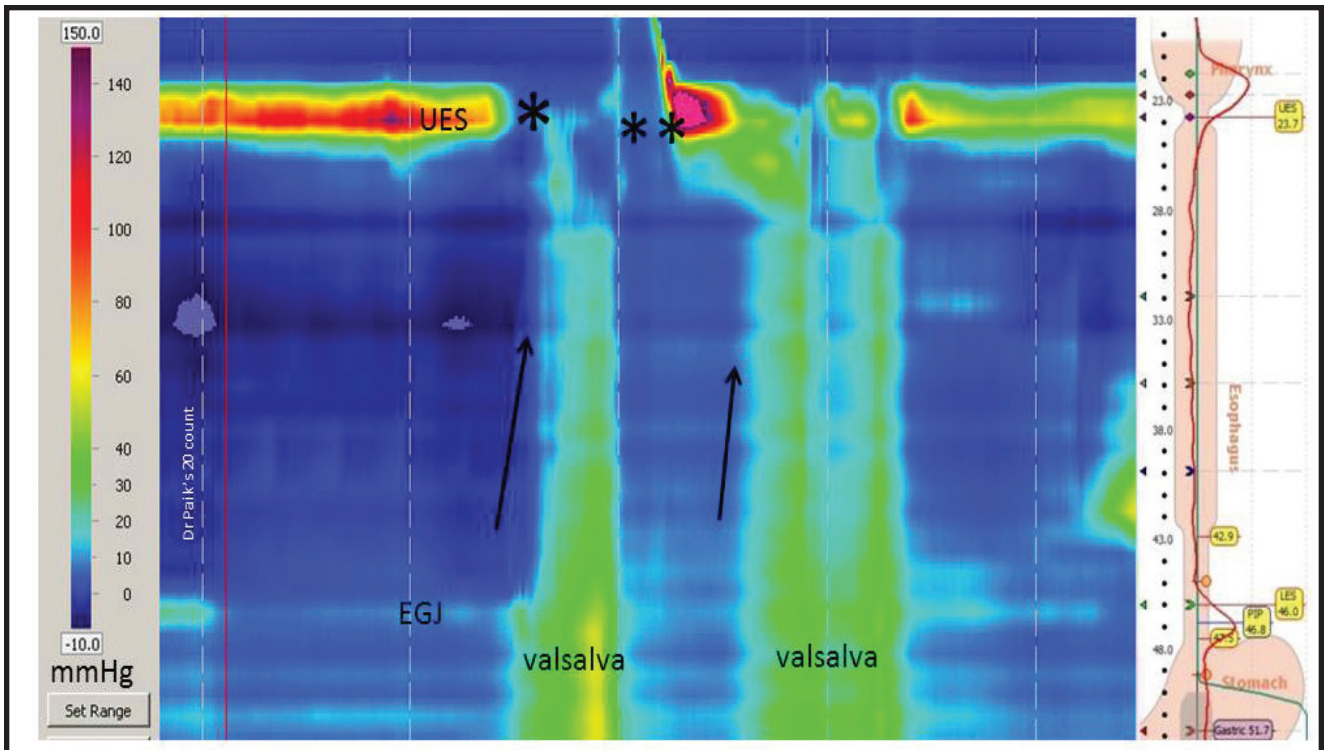


**Figure 3. Aerophagia**

**Left:** During a high-resolution manometry with concomitant impedance test, the patient was instructed to perform Dr. Paik's 20 count; the patient in a sitting position was instructed to count to 20 out loud and swallow at will. The patient swallows saliva (liquid) and air. The peristalsis of the esophagus actively moves air down the esophagus into the stomach.

**Right:** The concomitant impedance test shows aboral air movement (arrow). Gas has a high impedance and liquid has a low impedance. The purple color represents liquid signal.

HRM: High Resolution Esophageal Manometry; EGJ: Esophagogastric junction; UES: upper esophageal sphincter



**Figure 4. Rumination**

HRM showing rumination: valsalva induced increase in intragastric pressures, relaxation of the UES (\*) and retrograde movement of a pressure wave from the stomach up the esophagus (arrow). A swallow (\*\*) follows the event with subsequent repeat behavior. HRM: High Resolution Esophageal Manometry; EGJ: Esophagogastric junction; UES: upper esophageal sphincter

repercussions.<sup>19</sup> Given that supragastric and excessive belching are likely behavioral disorders, cognitive behavioral therapy can be used as a treatment strategy. The primary step in treatment is offering reassurance and a thorough explanation of the cause of the belching. Speech therapy and breathing exercises can be utilized. Patients should be educated on modifying their habits, as supragastric belching is a self-induced, learned behavior.<sup>20</sup> For example, breathing exercises with the emphasis on abdominal breathing reduce the belching episodes through behavior modification.

Gum chewing has no effect on the frequency of gastric or supragastric belches, but in fact may exacerbate belching disorders by increasing the amount of air and saliva swallowed.<sup>21</sup> Simethicone and similar drugs have not been found to be beneficial in patients with belching. Baclofen, a GABA<sub>B</sub> receptor agonist, used in patients with refractory GERD to decrease TLESR, has been studied for its use in patients with belching. It was found to be effective in reducing both supragastric belching and aerophagia<sup>22</sup> thus providing complementary therapy to behavioral modification.

## Aerophagia

It may be difficult to differentiate aerophagia (Greek for 'air eating') and excessive belching. However, these two conditions are very different in terms of the direction of air movement in and out of the mouth and esophagus. Patients with aerophagia swallow air too often and in large quantities. In aerophagia, peristalsis of the esophagus actively moves air down the esophagus into the stomach, whereas in supragastric belching there is no esophageal peristalsis. Furthermore, a supragastric belch is completed within one single second, in contrast to aerophagia.<sup>23</sup> Intraluminal impedance monitoring has allowed accurate differentiation of these two conditions. (Figure 3) Supragastric belching is not a predominant symptom in patients with aerophagia but they do experience gastric belching episodes. Patients with aerophagia have symptoms of bloating, distension and flatulence. An abdominal X-ray may show increased intragastric and intra-intestinal air. The management of aerophagia is based on expert and local opinion as no standard treatment exists. Consideration of speech

(continued on page 40)



(continued from page 38)

therapy could be considered, but no published reports exist.<sup>24</sup>

## Rumination

Rumination is an eating disorder characterized by recurrent regurgitation of recently ingested food or liquid into the mouth, followed by re-chewing, re-swallowing or expulsion. The effortless regurgitation of these recently ingested gastric contents occurs within 15-20 minutes of intake. The event is often preceded by belching before fluid and food are regurgitated.<sup>25</sup> This condition was thought to predominantly occur in adults and children with developmental delay, but it also occurs in otherwise healthy people. Rumination was traditionally diagnosed based on the history provided by the patient, but esophageal manometry and impedance studies can be used to confirm the diagnosis. The characteristic manometric pattern of rumination shows an abrupt rise in intragastric pressure followed by an increase in intra-esophageal pressure in all channels. (Figure 4) This pressure rise has been referred to as the “R” wave, and occurs when the patient is asked to drink a liquid or swallow food. The importance of a diagnostic test in rumination syndrome is to exclude other conditions that present with postprandial vomiting and regurgitation such as achalasia and GERD. The mainstay of treatment for this condition is a thorough explanation of the disorder followed by behavioral therapy and breathing exercises to distract the patient while eating. In addition, rumination syndrome is associated with the setting of great stress and emotional factors, therefore often requiring concomitant care with a psychologist or counselling. Tricyclic antidepressants are also very helpful during the breathing and relaxation/distraction approach.<sup>26</sup>

## CLINICAL PEARLS

Major advancements have been made in recognizing and differentiating belching, aerophagia, rumination and GERD as distinct clinical entities largely through the use of esophageal impedance. Supragastric belching differs from gastric belching in terms of its pathophysiology and often becomes a behavioral response to some ongoing, unpleasant gastrointestinal sensation like GERD. Reflux symptoms occur more commonly in patients with supragastric belching than in healthy controls. Patients with aerophagia have gastric belching due to excessive air swallowing. Rumination

syndrome can be accurately diagnosed with impedance studies. Breathing exercises to distract the patient as well as behavioral therapy are the mainstay of treatment. It is hoped that as our understanding of these conditions continues to evolve, newer treatment options will also become available for these patients. ■

## References

1. Kessing B, Bredenoord A, Smout A. The pathophysiology, diagnosis and treatment of excessive belching symptoms. *Am J Gastroenterol.* 2014;109:1196-1203.
2. Bredenoord A. Excessive belching and aerophagia: two different disorders. *Dis Esophagus.* 2010;23:347-352.
3. Hemmink G, Bredenoord A, Weusten B, et al. Supragastric belching in patients with reflux symptoms. *Am J Gastroenterol.* 2009;104:1992-1997.
4. Hemmink G, Weusten B, Bredenoord A, et al. Increased swallowing frequency in GORD is likely to be caused by perception of reflux episodes. *Neurogastroenterol Motil.* 2009;21:143-8.
5. Sun X, Ke M and Wang Z. Clinical features and pathophysiology of belching disorders. *Int J Clin Exp Med.* 2015;8:21906-21914.
6. Bredenoord A. Excessive belching and aerophagia: two different disorders. *Dis Esophagus.* 2010;23:347-352.
7. Kessing B, Bredenoord A and Smout A. Mechanisms of gastric and supragastric belching: a study using concurrent high-resolution manometry and impedance monitoring. *Neurogastroenter Motil.* 2012;25:573-579.
8. Kessing B, Bredenoord A and Smout A. Mechanisms of gastric and supragastric belching: a study using concurrent high-resolution manometry and impedance monitoring. *Neurogastroenter Motil.* 2012;25:573-579.
9. Bredenoord A, Weusten B, Sifrim D, et al. Aerophagia, gastric and supragastric belching: a study using intraluminal electrical impedance monitoring. *Gut.* 2004;53:1561-1565.
10. Karamanolis G, Triantafyllou K, Tsiamoulos Z, et al. Effect of sleep on excessive belching: a 24-hour impedance-pH study. *J Clin Gastroenterol.* 2010;44:332-4.
11. Bredenoord A, Weusten B, Timmer R, et al. Physiological factors affect the frequency of belching in patients with aerophagia. *Am J Gastroenterol.* 2006;101:2777-2781.
12. Kessing B, Bredenoord A, Smout A. The pathophysiology, diagnosis and treatment of excessive belching symptoms. *Am J Gastroenterol.* 2014;109:1196-1203.
13. Koukias N, Woodland P, Yazaki E, et al. Supragastric belching: prevalence and association with gastroesophageal reflux disease and esophageal hypomotility. *J Neurogastroenterol Motil.* 2015;21:398-403.
14. Koukias N, Woodland P, Yazaki E, et al. Supragastric belching: prevalence and association with gastroesophageal reflux disease and esophageal hypomotility. *J Neurogastroenterol Motil.* 2015;21:398-403.
15. Klausner A, Schindlbeck N and Muller-Lissner S. Symptoms in gastro-oesophageal reflux disease. *Lancet.* 1990;335:205-8.
16. Bredenoord A, Weusten B, Timmer R, et al. Relationships between air swallowing, intragastric air, belching and gastro-oesophageal reflux. *Neurogastroenterol Motil.* 2005;17:341-347.
17. Hemmink G, Bredenoord A, Weusten B, et al. Supragastric belching in patients with reflux symptoms. *Am J Gastroenterol.* 2009;104:1992-1997.
18. Kessing B, Bredenoord A, Velosa M, et al. Supragastric belches are the main determinant of troublesome belching symptoms in patients with gastroesophageal reflux disease. *Aliment Pharmacol Ther.* 2012;35:1073-1079.
19. Ooi J, Vardar R and Sifrim D. Supragastric belching. *Curr Opin Gastroenterol.* 2016;32:302-309.
20. Chitkara D, Bredenoord A, Talley N, et al. Aerophagia and rumination: recognition and therapy. *Curr Treat Options Gastroenterol.* 2006;9:305-13.
21. Da Silva A, Aprile L and Dantas R. Effect of gum chewing on air swallowing, saliva swallowing and belching. *Arq Gastroenterol.* 2015;52:190-194.
22. Blondeau K, Boecxstaens V, Rommel N, et al. *Clin Gastroenterol Hepatol.* 2012;10:379-84.
23. Hemmink G, Bredenoord A, Weusten B, et al. Supragastric belching in patients with reflux symptoms. *Am J Gastroenterol.* 2009;104:1992-1997.
24. Bredenoord A. Management of belching, hiccups and aerophagia. *Clin Gastroenterol Hepatol.* 2013;11:6-12.
25. Hejazi R and McCallum R. Rumination syndrome: A review of current concepts and treatments. *Am J Med Sci.* 2014;348:324-329.
26. Kessing B, Smout A and Bredenoord A. Current diagnosis and management of the rumination syndrome. *J Clin Gastroenterol.* 2014;48:478-483.