

# CLINICAL PRACTICE UPDATE: EXPERT REVIEW

## Diagnosis and Treatment of Rumination Syndrome

Magnus Halland,\* John Pandolfino,† and Elizabeth Barba§



\*Division of Gastroenterology and Hepatology, Mayo Clinic, Rochester, Minnesota; †Division of Gastroenterology and Hepatology, Department of Medicine, Feinberg School of Medicine, Northwestern University, Northwestern Memorial Hospital, Chicago, Illinois; and §Digestive System Research Unit, University Hospital Vall d'Hebron, Barcelona, Spain

Rumination syndrome is a functional gastrointestinal disorder characterized by effortless postprandial regurgitation. The disorder appears uncommon, although only limited epidemiologic data are available. Awareness of the characteristic symptoms is essential for recognizing the disorder, and thus avoiding the long delay in diagnosis, that many patients experience. Although objective testing by postprandial esophageal high-resolution impedance manometry is available in select referral centers, a clinical diagnosis can be made in most patients. The main therapy for rumination syndrome is behavioral modification with postprandial diaphragmatic breathing. This clinical practice update reviews the pathophysiology, diagnosis, and treatment of rumination syndrome.

**Best Practice Advice 1:** Clinicians strongly should consider rumination syndrome in patients who report consistent postprandial regurgitation. Such patients often are labeled as having refractory gastroesophageal reflux or vomiting.

**Best Practice Advice 2:** Presence of nocturnal regurgitation, dysphagia, nausea, or symptoms occurring in the absence of meals does not exclude rumination syndrome, but makes the presence of it less likely.

**Best Practice Advice 3:** Clinicians should diagnose rumination syndrome primarily on the basis of Rome IV criteria after an appropriate medical work-up.

**Best Practice Advice 4:** Diaphragmatic breathing with or without biofeedback is the first-line therapy in all cases of rumination syndrome.

**Best Practice Advice 5:** Instructions for effective diaphragmatic breathing can be given by speech therapists, psychologists, gastroenterologists, and other health practitioners familiar with the technique.

**Best Practice Advice 6:** Objective testing for rumination syndrome with postprandial high-resolution esophageal impedance manometry can be used to support the diagnosis, but expertise and lack of standardized protocols are current limitations.

**Best Practice Advice 7:** Baclofen, at a dose of 10 mg 3 times daily, is a reasonable next step in refractory patients.

*Keywords:* Rumination Syndrome.

Rumination syndrome is a functional gastrointestinal disorder of unknown etiology characterized by effortless, often repetitive, regurgitation of recently ingested food into the mouth.<sup>1,2</sup> The regurgitated material can either be chewed and reswallowed or expectorated by the patient. Typically, regurgitation is not preceded by

nausea or retching and is not selective for liquids or solids. The clinical implications of rumination syndrome range from a relatively minor social inconvenience to disabling nutritional impairment.<sup>2</sup> Rumination episodes are induced by an increase in intragastric pressure, which is generated by a voluntary but unperceived and unintentional contraction of the abdominal wall musculature. When this increase in gastric pressure overcomes the pressure of the lower esophageal sphincter, gastric content can flow freely into the esophagus and mouth.<sup>3</sup> Not unsurprisingly, patients typically use the word vomiting to describe rumination events, and many patients are misdiagnosed as having refractory vomiting, gastroesophageal reflux disease, or gastroparesis. A long delay in receiving a diagnosis is common and can lead to unnecessary testing, a reduced quality of life, and even invasive procedures such as surgery or feeding tubes.<sup>2,4,5</sup>

### Methods

The recommendations outlined in this review are based on expert opinion and on relevant publications from PubMed and Embase (through February 2018) without a formal systematic review of evidence. To identify relevant ongoing trials, we queried [clinicaltrials.gov](http://clinicaltrials.gov). The Clinical Practice Updates Committee of the American Gastroenterological Association has reviewed these recommendations.

### Epidemiology

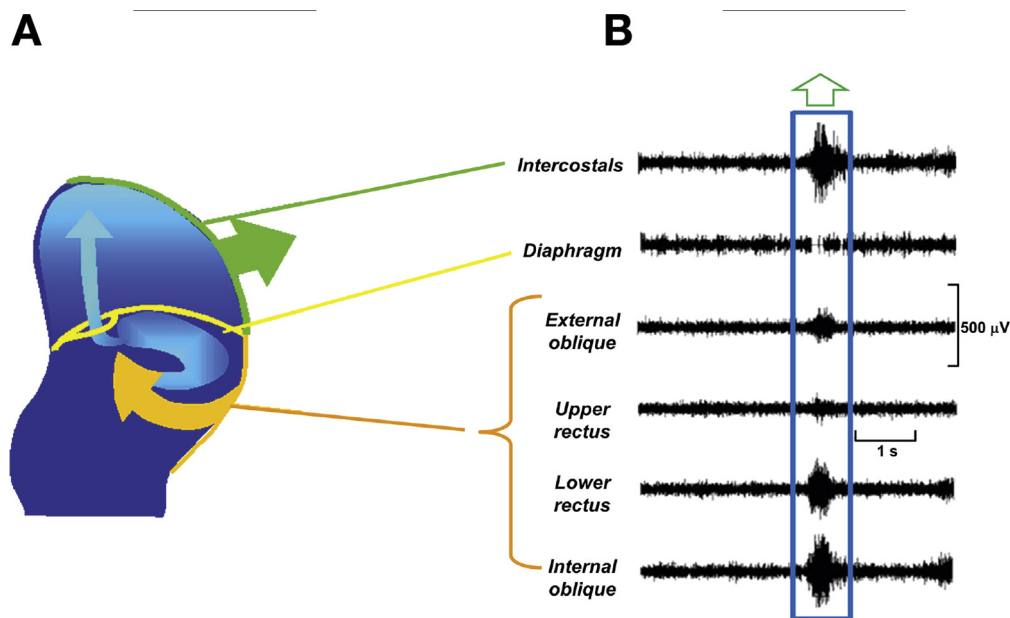
Rumination syndrome is thought to be uncommon, but epidemiologic data on the incidence and prevalence are very limited.<sup>2,6</sup> The prevalence in adults was found to be 0.8% and 0.9%, respectively, in 2 population-based studies from Australia and Mexico, which combined included 3000 people.<sup>7,8</sup> A much higher prevalence has been reported among special populations such as

**Abbreviations used in this paper:** EMG, electromyography; HRIM, high-resolution impedance manometry.

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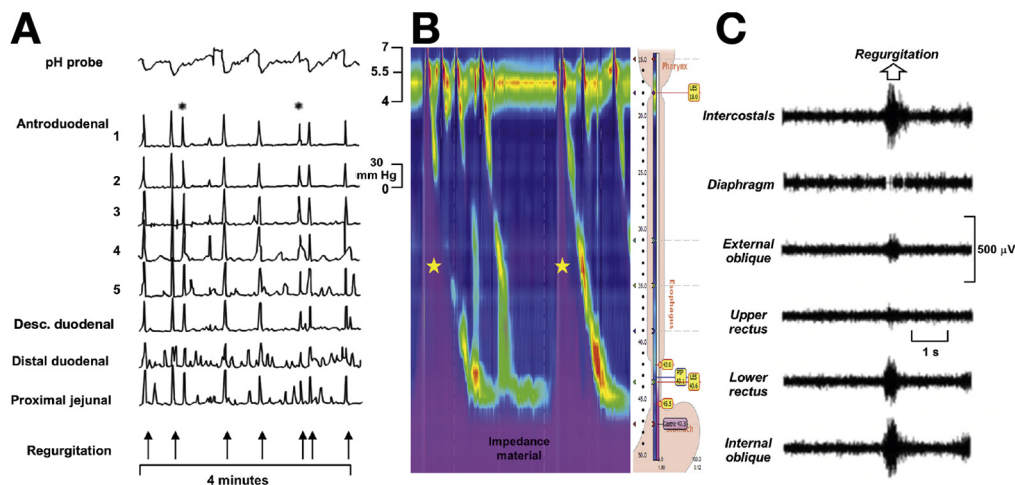


**Figure 1.** Muscular mechanism of rumination by electromyography. (A) Rumination (light blue arrow) occurs as a result of abdominal compression (orange arrow), coupled with chest expansion (green arrow). (B) Electromyography showing increased intercostal activity and abdominal wall activation during rumination events (blue box).

patients with eating disorders and fibromyalgia, in which 7% to 8% of patients reported rumination syndrome.<sup>9,10</sup> Very few studies are available in pediatric and adolescent populations. A cross-sectional study of 1231 children aged 0 to 48 months in Colombia found that rumination syndrome was the second most common functional gastrointestinal disorder, with a prevalence of 4.7%.<sup>11</sup> In a questionnaire-based study of 2161 adolescents from Sri Lanka, 5.1% of responders fulfilled the clinical criteria for rumination syndrome, of whom 12% reported significant functional impairment secondary to their rumination symptoms.<sup>12</sup> Some of the earliest observations of rumination in human beings suggested that the syndrome occurs predominantly among children and adults with development delay,<sup>13-15</sup> but more recent case series and studies have suggested that most patients with rumination are of normal intellect.<sup>3,5,16</sup> Because of the lack of awareness among many physicians, it is conceivable that the true prevalence of rumination syndrome is underestimated.

### Etiology and Pathophysiology

The exact pathogenesis of rumination syndrome remains incompletely understood. The hallmark feature of rumination syndrome is the postprandial retrograde flow of ingested gastric content into the mouth of the patients. Mechanistically, this is thought to occur owing to a combination of increased intra-abdominal pressure coupled with negative intrathoracic pressure, resulting in a permissive esophagogastric gradient (Figure 1). However, few, if any, healthy people have the ability to induce rumination and thus an unrecognized central reflex mechanism also might be at play. Rumination events have been characterized with gastroduodenal manometry, abdominal wall electromyography (EMG), and high-resolution impedance manometry (HRIM) in various studies (Figure 2). Typical findings during a gastroduodenal manometry include a characteristic spike pattern recorded simultaneously across all sensors, termed the “R” wave.<sup>17</sup> During EMG recordings,



**Figure 2.** (A) Rumination shown on gastroduodenal manometry; R waves are marked with asterisks and coincide with regurgitation. (B) High-resolution impedance manometry; impedance detected rumination events noted with stars. (C) Electromyography shows activation of intercostal and abdominal wall muscles during rumination.

postprandial activation of the abdominal wall correlates with regurgitation events and patient symptoms.<sup>16,18</sup> Several studies that used postprandial esophageal HRIM now have shown that events of gastric pressurization exceeding 30 mm Hg are associated with rumination events and differentiate patients with rumination from those with gastroesophageal reflux disease.<sup>3,19</sup>

In addition, 3 main patterns of rumination have been recognized.<sup>5</sup> Classic or primary rumination is characterized by the absence of any preceding events, whereas reflux rumination, also termed *secondary rumination*, occurs exclusively after a reflux episode. Supragastric rumination is caused by air swallowing and subsequent gastric straining.<sup>5</sup> In pediatric populations, both primary and secondary rumination has been observed,<sup>20</sup> but it currently is unknown whether different patterns of rumination are a useful clinical tool in the management of either adult or pediatric patients. Elevation of the gastroesophageal junction into the thorax creating a false hernia has been reported both in patients with rumination<sup>21</sup> and in healthy controls,<sup>22</sup> however, the clinical significance of this physiology is uncertain.

The few studies that have evaluated gastric function among patients with rumination syndrome have produced conflicting results. For example, in a study of 15 patients with rumination syndrome that assessed gastric accommodation with gastric mucosal single-photon-emission computed tomography methodology<sup>23</sup> there was no difference in accommodation when compared with controls.<sup>24</sup> An earlier study, however, which used a barostat technique, showed accommodation abnormalities in 50% of patients with rumination.<sup>25</sup> The majority of patients with rumination syndrome appear to have normal gastric emptying.<sup>24</sup> A higher-than-population-level burden of anxiety and depression among patients with rumination also has been noted in several studies.<sup>2,4,18</sup>

### *Clinical Presentation and Symptoms*

The main symptom of rumination is repetitive regurgitation of recently ingested food and fluid into the mouth, not preceded by nausea or retching, although patients typically describe their symptoms as vomiting. Regurgitation typically occurs 10 to 15 minutes after a meal,<sup>18</sup> but can persist for up to 1 to 2 hours. The regurgitated material might be swallowed again or expectorated.<sup>16,18</sup> In some patients symptoms may be intermittent or dependent on the size and content of the meal; however, in the majority of patients, rumination occurs invariably after meals regardless of the type of food. Rumination can occur even after ingestion of liquids only. Characteristically, the ingestion of liquids facilitates rumination of solid food. The regurgitate usually lacks a sour and bitter taste and often is described as tasting similar to the food recently ingested.<sup>2</sup> Symptoms usually diminish when the refluxate becomes acidic and rumination does not occur when the patient is asleep. Heartburn is reported less frequently

and associated erosive esophagitis usually is not present, but when present does not exclude the diagnosis.<sup>2,26,27</sup> In a group of patients younger than 16 years of age halitosis was the main initial reason for seeking advice.<sup>14</sup> Another observation is a potential association between rumination and evacuation disorders. In 1 study of 438 adults and adolescents with a rectal evacuation disorder, rumination syndrome was present in 13%.<sup>4</sup>

Weight loss has been observed in approximately 40% of patients, but complications such as electrolyte disturbances and malnutrition appear much less common in adult patients.<sup>2</sup> Dental erosions and frequent caries appear rarely in adults, but might be a more common feature in pediatric patients.<sup>28</sup> The presence of other gastrointestinal symptoms not included in the Rome IV classification of rumination, such as nausea, heartburn, abdominal discomfort, bloating, diarrhea, belching, and abdominal pain, does not exclude the possibility of rumination syndrome.

### *Differential Diagnoses*

Rumination should be considered in the differential diagnosis of postprandial regurgitation and vomiting, especially when they are associated with weight loss. Another feature that differentiates rumination syndrome from gastroesophageal reflux disease is the failure to improve after antisecretory treatment, and, in fact, antisecretory agents actually may worsen rumination symptom.<sup>29</sup> In contrast to rumination, vomiting in gastroparesis generally is intermittent and preceded by nausea and retching, and occurs typically late postprandially, and the vomitus is no longer recognizable as ingested food. Achalasia also shares clinical features with rumination syndrome and needs to be considered in the diagnostic work-up, although reswallowing is not common and achalasia patients often stop eating at the first occurrence of regurgitation, which differs from patients with rumination syndrome. Patients with eating disorders such as bulimia and anorexia may report postprandial regurgitation or vomiting. An underlying eating disorder has been reported in up to 20% of patients with a diagnosis of rumination syndrome and thus we recommend considering potential psychiatric diagnoses in all patients who report consistent postprandial regurgitation.<sup>4</sup>

### *Diagnostic Testing*

Rumination syndrome is diagnosed by a complete clinical history, with subsequent application of the Rome IV criteria<sup>30</sup> (Table 1). In most patients, a clinical diagnosis can be made, however, we recommend having a low threshold for further evaluation in clinically diagnosed cases, particularly if response to treatment is not observed. However, this is not a common scenario because in clinical practice most patients undergo an

**Table 1.** Clinical Diagnosis of Rumination in Adults

Rome IV criteria
Persistent or recurrent regurgitation of recently ingested food into the mouth with subsequent spitting or remastication and swallowing
Regurgitation is not preceded by retching
Supportive criteria
Effortless regurgitation events usually are not preceded by nausea
Regurgitant contains recognizable food that might have a pleasant taste
The process tends to cease when the regurgitated material becomes acidic
Criteria fulfilled for the past 3 months with symptom onset at least 6 months before diagnosis

esophagogastroduodenoscopy or a barium esophagography to rule out mucosal or obstructive causes for their symptoms before being diagnosed with rumination syndrome. Furthermore, several studies have reported that patients with rumination visit an average of 5 physicians over 2.7 to 4.9 years before being diagnosed correctly with rumination syndrome, and often undergo repeated and unnecessary tests.<sup>2,26</sup> Objective testing is not strictly necessary to diagnose rumination syndrome, but can help to support the diagnosis and convince patients and their families of the rumination syndrome diagnosis (Figure 1).

Postprandial HRIM allows detection of gastric pressurizations associated with return of ingested material into the proximal esophagus.<sup>5,19</sup> No standardized protocols for testing currently exist, and limited expert centers offer such testing to suspected cases of rumination syndrome. Although gastroduodenal manometry can be used to diagnose rumination syndrome, it is used less commonly in clinical practice given that it is invasive and of limited availability.

Another technique is an EMG of the anterior abdominal wall and intercostal muscles. This approach can identify one of the key underlying mechanisms of rumination and is both a diagnostic and therapeutic technique. In patients with rumination the episodes of regurgitation are associated with a characteristic EMG pattern featuring an abrupt (duration, 0.6 s) and simultaneous increase in activity of the intercostals (with thoracic suction) and muscles of the anterior abdominal wall<sup>18</sup> (abdominal compression). However, EMG typically only is available at select expert centers.

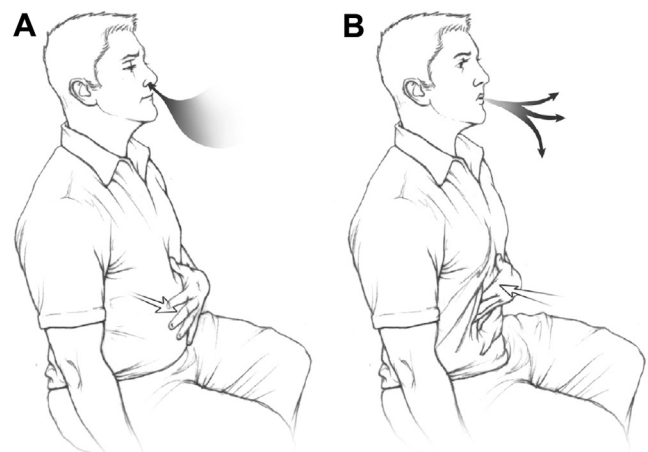
#### *Diaphragmatic Breathing Without or With Biofeedback*

The cornerstone of treatment of rumination syndrome is a thorough explanation of the condition and the underlying mechanism responsible for the rumination episodes. It is interesting to note that the abdominothoracic maneuver, which is part of the mechanism of

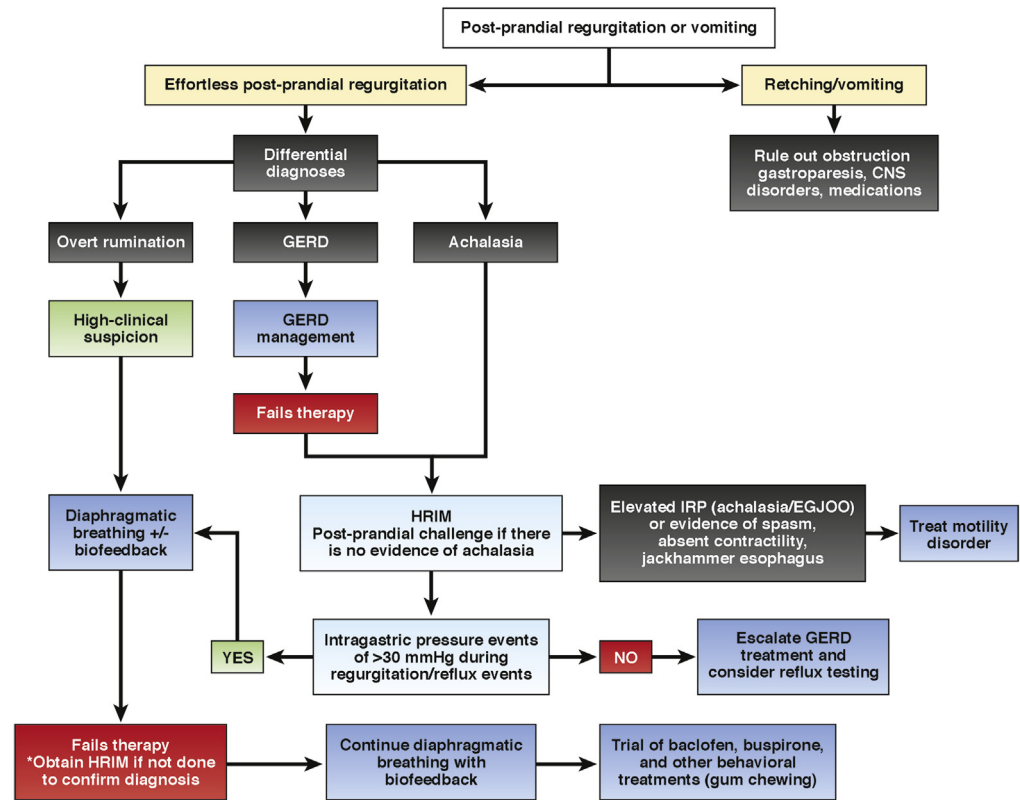
the rumination, generally passes unnoticed to the patient, possibly because the coordination of the 3 components (thoracic suction, abdominal thrust, and hiatal opening) produces regurgitation with a very brief and relatively smooth maneuver. Abdominal wall muscles actively modulate the intra-abdominal content by changes in the muscular tone of the anterior wall, the diaphragm, and the thoracic musculature.

EMG and HRIM equipment coupled with expertise to perform biofeedback is not universally available, and thus most patients are taught diaphragmatic breathing without biofeedback. Diaphragmatic breathing can be learned easily by putting a hand on the chest and on the abdomen during respiration, and only allowing the hand on the abdomen to move out with inspiration,<sup>31</sup> while the chest remains in position (Figure 3). We instruct patients to take breaths by protruding the abdomen while keeping the chest as stationary as possible. Each inhalation or exhalation should be slow and complete, aiming for 6 to 8 respirations per minute. We recommend diaphragmatic breathing for 15 minutes after each meal, or longer if the sensation of impending rumination remains. The technique also should be practiced in the absence of meals to become expert at the technique. Uncontrolled studies and case series have reported resolution or improvement in rumination symptoms after diaphragmatic breathing in 20%–66% of patients.<sup>14,32</sup>

From a mechanistic perspective, biofeedback therapy has been shown to modify basal postprandial muscular tone and suppress rumination activity.<sup>16</sup> During biofeedback guided by EMG, patients are trained to control the activity of the abdominothoracic muscles under visual control of real-time EMG recordings shown on a monitor. Specifically, patients are instructed to voluntarily reduce the activity of intercostal and anterior abdominal muscles and to increase the activity of the diaphragm. After EMG-directed biofeedback sessions, patients are instructed to perform the same exercises



**Figure 3.** Diaphragmatic breathing. (A) The patient slowly inhales through the nose while protruding the abdomen and keeping the chest stationary. (B) The patient slowly exhales via the mouth and allows the abdomen to retract.



**Figure 4.** Approach to the patient with postprandial regurgitation or vomiting. A suggested approach to patients who report post-prandial symptoms and vomiting is outlined, including a key, but not an exhaustive, differential diagnosis. CNS, central nervous system; EGJOO, esophagogastric junction outflow obstruction; GERD, gastroesophageal reflux disease; IRP, integrated relaxation pressure.

daily at home for 5 minutes before and after meals. In 1 study of patients treated with biofeedback therapy guided by EMG, a significant reduction in the number of regurgitation events was observed compared with the basal challenge test, from 18 episodes of regurgitation per day to 8 episodes ( $P < .001$ ), and after biofeedback therapy patients also reported improved meal tolerance. After 6 months patients continued to improve, with a reduction of rumination episodes to less than 1 episode per day.<sup>16,18</sup> In a randomized controlled trial, compared with sham, EMG-guided biofeedback treatment resulted in a  $74\% \pm 6\%$  reduction in rumination activity (from  $29 \pm 6$  before to  $7 \pm 2$  daily events after intervention) vs  $1\% \pm 14\%$  during sham (from  $21 \pm 2$  before to  $21 \pm 4$  daily events after intervention) ( $P = .001$ ).<sup>18</sup> Similarly, in an observational study in which postprandial HRIM tracings were used as a biofeedback tool, diaphragmatic breathing effectively reduced rumination activity, but rumination episodes restarted promptly when patients resumed their normal breathing pattern.<sup>3</sup> Diaphragmatic breathing not only reduced postprandial intragastric pressure, but it also increased esophagogastric junction pressure, suggesting that this is an additional mechanism by which behavioral therapy works.<sup>3</sup>

*Medical and Surgical Therapy*

Pharmaceuticals that enhance gastric accommodation, emptying, or lower esophageal sphincter function

might potentially be helpful in rumination syndrome. To date, only 2 studies have examined the impact of pharmacotherapy in rumination syndrome. The antipsychotic levosulpiride, a selective dopamine D<sub>2</sub>-receptor antagonist with prokinetic activity, was examined in 21 adults with rumination syndrome over an 8-month period in combination with supportive psychotherapy. In this study, 38% of the treated patients reported an improvement in symptoms, whereas 48% reported no change and 14% described worsening of symptoms.<sup>33</sup> Baclofen, a  $\gamma$ -aminobutyric acid agonist that suppresses transient lower esophageal sphincter relaxations, is another medication that is used to treat rumination syndrome. In an open-label, 1-week study, baclofen reduced postprandial rumination events after a 1000-kcal meal in 12 adult patients. Furthermore, in a randomized cross-over trial in 22 patients, of whom 16 had rumination syndrome, baclofen 10 mg 3 times daily compared with placebo led to a modest reduction in flow events during a postprandial manometry.<sup>34</sup> In addition, 63% of patients reported symptom improvement during the baclofen period compared with 26% during the placebo period. Buspirone, a 5-hydroxytryptamine 1A-receptor agonist that induces fundic relaxation, is superior to placebo among patients with functional dyspepsia,<sup>35</sup> but no trials in rumination syndrome have been performed. Given that some studies have suggested that up to 50% of patients with rumination syndrome may have impaired fundic relaxation,<sup>25</sup> a trial with

bupirone is reasonable, although anecdotally the clinical benefit appears to be limited. Finally, chewing gum has been reported as beneficial in 2 case reports of pediatric and adolescent patients.<sup>36,37</sup>

A small case series noted that 5 patients who did not respond to medical or behavioral therapy experienced symptom relief after fundoplication.<sup>38</sup> However, given that prior studies of patients with rumination syndrome included patients who reported ongoing symptoms despite having undergone fundoplication,<sup>5</sup> the role for fundoplication surgery in rumination syndrome remains uncertain. Another single case report indicated clinical improvement after subtotal gastrectomy in a severe refractory case of rumination.<sup>39</sup> In the absence of any controlled data, coupled with the risks of surgery, we recommend avoiding surgery as a therapy for rumination syndrome. Currently, a role, if any, of surgery in refractory patients remains investigational.

### *Information Gaps and Areas of Future Research*

As this review has highlighted, multiple questions remain unanswered with regard to rumination syndrome, and thus future research is needed. Future studies hopefully will address the epidemiology of rumination syndrome, because data on incidence, prevalence, and risk factors are very limited. The impact of rumination syndrome on quality of life remains unexplored. Unlike many other functional gastrointestinal disorders, no validated tools currently exist for the diagnosis and measurement of symptoms in rumination syndrome. Although the effectiveness of diaphragmatic breathing has been explored in a single short-term randomized trial, more knowledge about the efficacy and durability of this technique is needed. Finally, the pathophysiology and initiating factors of rumination syndrome remain a mystery. Indeed, the basic question of how subconsciously one can learn to regurgitate still needs to be answered.

## **Summary and Conclusions**

Rumination syndrome is an uncommon functional gastrointestinal disorder, but likely is under-recognized in clinical practice. We recommend that physicians consider rumination syndrome in the differential diagnosis of patients presenting with regurgitation, refractory gastroesophageal reflux, or vomiting. A clinical diagnosis can be made in most cases. The algorithm in [Figure 4](#) outlines a suggested approach to patients with postprandial regurgitation or vomiting, with a focus on how to evaluate for potential rumination syndrome.

The main therapy for rumination syndrome is diaphragmatic breathing, which is relatively easy to learn and appears effective in many patients. We recommend referring patients to a behavioral psychologist, physiotherapist, or even to yoga instructors to learn

diaphragmatic breathing, depending on local resources. Many patients appear able to learn diaphragmatic breathing, even in a single office session with a motivated physician.<sup>31,40</sup>

Future research is needed to clarify the pathophysiology, epidemiology, and therapeutics in rumination syndrome.

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**Reprint requests**

Address requests for reprints to: John E. Pandolfino, MD, MSCI, Division of Gastroenterology and Hepatology, Department of Medicine, Feinberg School of Medicine, 676 N. St Clair Street, Suite 1409, Chicago, Illinois 60611. e-mail: j-pandolfino@northwestern.edu; fax: (312) 695-3999.

**Conflicts of interest**

The authors disclose no conflicts.