

REVIEW ARTICLE

# Symptomatic Approach to Gas, Belching and Bloating with OMT Treatment Options

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- Belching
- Bloating
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- Osteopathic Manipulative Treatment
- Prevention and Wellness

**ABSTRACT:** Intestinal gas production is a normal physiologic process. However, there are many pathophysiologic processes that can cause patients to experience bloating, abdominal pain, and distension from abnormal gas production or mobility. It is important for primary care physicians to understand the causes and mechanisms for both physiologic and pathologic gas and bloating in order to appropriately and effectively treat our patient population. This article will review the differential diagnosis of gas, bloating and belching, the necessary work-up, and the management of these disorders.

## INTRODUCTION

Gas, bloating, and belching are common gastrointestinal (GI) symptoms reported in the primary care office. As many as 30% of the U.S. population experiences bloating symptoms, and most of these patients describe their symptoms as moderate to severe.<sup>1</sup> Common causes of these symptoms include aerophagia, gastroesophageal reflux disease (GERD), irritable bowel syndrome (IBS), small bacterial intestinal overgrowth (SIBO), and malabsorption. These disorders can lead to significant discomfort and pain. Once diagnosed, there are treatment options including dietary changes and medications that can provide relief and improve the patient’s quality of life.

## GAS PRODUCTION

Ninety-nine percent of gas in the intestinal tract consists of nitrogen (N<sub>2</sub>), oxygen (O<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), hydrogen (H<sub>2</sub>) and methane. Swallowing is the primary cause of air in the stomach. Every time a person swallows he or she also ingest several milliliters of gas, comprised mostly of nitrogen and oxygen. Most of this gas is belched and usually does not make it to the duodenum.<sup>1</sup>

The primary cause of gas production in the colon is fermentation by colonic bacteria. Most people have about 100-200 milliliters of gas in our GI tract at any given time. Approximately 500 different species of bacteria reside within the colon, and nearly all of these species are anaerobes. Species of colonic bacteria differ between each individual depending on diet, antibiotic use, and how the patient was fed as an infant. The volume of gas increases after eating. Some food products that are incompletely digested within the small intestine such as lactose, fructose, sorbitol, legumes, fiber, and complex carbohydrates are broken down in the colon by colonic bacteria.<sup>1</sup>

**TABLE 1:**

Common causes of gas, bloating and belching.

- Aerophagia	- Lactose Intolerance
- Irritable Bowel Syndrome (IBS)	- Fructose Intolerance
- Small Intestinal Bacterial Overgrowth (SIBO)	- Celiac Disease

## BELCHING

Every time a person swallows air is ingested. This air then travels down the esophagus through peristalsis and accumulates in the proximal stomach. When beverages with CO<sub>2</sub> and bicarbonate are all ingested, larger volumes of gas accumulate. As the stomach becomes dilated with gas, stretch receptors are activated which triggers a vasovagal reflex. This reflex causes the lower esophageal sphincter and crural diaphragm to relax allowing intragastric air

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to escape. This mechanism prevents the stomach from becoming damaged by excessive dilation.<sup>2</sup>

Many patients with GERD report increased belching. Transient lower esophageal sphincter (LES) relaxation is the major mechanism for both belching and GERD. Recent studies have shown that the number of belches is related to the number of times someone swallows air. These studies have concluded that patients with GERD swallow more air in response to heartburn and therefore belch more frequently.<sup>3</sup> There is no specific treatment for belching in GERD patients, so for now, physicians continue to treat GERD with proton pump inhibitors (PPIs) and histamine-2 receptor antagonists with the goal of suppressing heartburn and chest pain symptoms. Some patients who undergo fundoplication as a treatment for reflux will lose the ability to belch leading to bloating and dilation of the stomach and intestines.<sup>2</sup>

## AEROPHAGIA

Aerophagia is the condition of excessive air swallowing and belching. Patients with this disorder can belch up to 20 times per minute. Stress can increase the frequency of belching. Aerophagia causes supragastric belching. There are two ways supragastric belching can occur. First, a patient can create negative intrathoracic pressure through inspiration against a closed glottis, allowing air to enter the esophageal body. Second, patients can bring air into the esophagus using their pharynx, palate and tongue. Supragastric belching or aerophagia usually does not occur with meals and does not have a scent or taste. It is considered a behavioral disorder exacerbated by anxiety. Treatment is usually behavior therapy or speech therapy to try to unlearn the belching behavior.<sup>2</sup>

## FLATULENCE

Flatulence is flatus passed through the anus. For most people flatulence is normal and does not cause pain or discomfort. However, many people experience excessive bloating and pain. The normal amount of flatus passed each day is usually between 500 and 1500 mL.<sup>4</sup> In fact, most patients who complain of excessive flatus will still fall into this range. Physiologic gas can be caused by intake of lactose, fructose, sorbitol; indigestible starches in fruits, vegetables, and legumes; and carbonated beverages. Simethicone (Mylicon<sup>®</sup> and Gas-X<sup>®</sup>) is a common medication used for abdominal bloating but has not been shown to relieve excessive flatulence.<sup>5</sup> Simethicone works by changing the surface tension of gas bubbles allowing for easier breakdown. Beano<sup>®</sup>, a dietary supplement that contains the enzyme, alpha-galactosidase, is a commonly used over-the-counter medication for excess flatulence. The polysaccharides and oligosaccharides found in foods such as legumes, broccoli and brussels sprouts are metabolized and fermented by large intestinal flora to produce gases. The enzyme in Beano<sup>®</sup> breaks these complex sugars into simple sugars making them easier to digest with less gas production.<sup>6</sup>

## IRRITABLE BOWEL SYNDROME (IBS)

IBS is abdominal pain or discomfort associated with altered bowel habits. It is the most commonly diagnosed GI disorder and accounts for about 30% of all GI referrals.<sup>7</sup> Criteria for IBS is recurrent abdominal pain at least one day per week in the last three months associated with at least two of the following: **1)** association with defecation, **2)** change in stool frequency, **3)** change in stool form. Diagnosis should be made using these clinical criteria and limited testing. Common symptoms are abdominal pain, bloating, alternating diarrhea and constipation, and pain relief after defecation. Pain can be present anywhere in the abdomen, but the lower abdomen is the most common location.<sup>8</sup> Abdominal bloating is a common complaint for the majority of these patients. Abdominal distension may also occur. The difference between bloating and distension is that bloating in the sensation of gassiness and fullness while distension is an actual increase in abdominal girth.<sup>1</sup> Studies have however shown that although patients with IBS feel gassy, they have a normal volume of gas in their intestinal tract compared to healthy individuals.<sup>9</sup> It is now believed that the cause of bloating and distension is due to impaired gas transit causing gas retention.<sup>10</sup>

There are three main types of IBS: IBS with predominant diarrhea, IBS with predominant constipation and IBS with mixed bowel habits. Patients should be encouraged to use the Bristol stool form scale (*Table 2*) to record stool consistency. When using the scale patients should not be on any medications to treat bowel habits.<sup>8</sup> Patients with constipation-variant IBS experience more abdominal distension due to prolonged transit time than those with diarrhea-variant IBS.<sup>11</sup>

**TABLE 2:**

Bristol stool form scale<sup>8</sup>

<b>Type 1</b>	Separate hard lumps, like nuts (hard to pass)
<b>Type 2</b>	Sausage-shaped but lumpy
<b>Type 3</b>	Like a sausage but with cracks on the surface
<b>Type 4</b>	Like a sausage or snake, smooth and soft
<b>Type 5</b>	Soft blobs with clear-cut edges
<b>Type 6</b>	Fluffy pieces with ragged edges, a mushy stool
<b>Type 7</b>	Watery, no solid pieces, entirely liquid

Gas related symptoms are commonly associated with food intolerance after eating poorly absorbable fermentable carbohydrate and polyols (FODMAPs). IBS patients may have a heightened sensitivity to poorly absorbable carbohydrates. These carbohydrates will be rapidly fermented by colonic bacteria leading to gas production, abdominal pain and flatulence.<sup>12</sup> It is important to obtain a full history of the patient's diet to try to determine which foods are exacerbating the patient's symptoms.

Patients with IBS may benefit from a diet low in FODMAPs (Table 3) and low in gas producing foods. Common gas producing foods include beans, onions, celery, carrots, raisins, bananas, apricots, prunes, brussels sprouts, wheat germ, pretzels, bagels, alcohol, and caffeine.<sup>14</sup>

**TABLE 3:**  
FODMAPs<sup>13</sup>

FERMENTABLE	
Oligosaccharides	Wheat, barley, rye, onion, leek, garlic, shallots, artichokes, beetroot, fennel, peas, chicory, pistachio, cashews, broccoli, brussels sprouts
Disaccharides	Milk, custard, ice cream, and yogurt
Monosaccharides	Apples, pears, mangoes, cherries, watermelon, asparagus, sugar snap peas, honey, high-fructose corn syrup
Polyols	Apples, pears, apricots, cherries, nectarines, peaches, plums, watermelon, mushrooms, cauliflower, artificial sweeteners

Fiber supplementation is a common treatment for patients who experience constipation. However, some patients will experience increased bloating with fiber supplementation. It is recommended to start a low dose of psyllium fiber (soluble fiber) of one-half to one tablespoon per day in patients with IBS with constipation to avoid worsening of IBS symptoms. Insoluble fibers (such as bran) are more likely to cause increase bloating and flatulence.<sup>8</sup>

In patients who fail fiber therapy, polyethylene glycol (Miralax<sup>®</sup>) is recommended. Miralax<sup>®</sup> works as an osmotic laxative, improving constipation symptoms by causing more spontaneous bowel movements and lessening straining, but does not improve symptoms of bloating and abdominal pain.<sup>15</sup> Some patients will experience worsening cramping and bloating when using Miralax<sup>®</sup>. However, Miralax<sup>®</sup> is still preferred over lactulose and milk of magnesia for the use in chronic constipation and IBS with constipation as it has similar, if not greater efficacy, and has less side effects.

Pharmacologic stimulation of gut motility in IBS patients reduces gas retention and abdominal distension.<sup>16</sup> Commonly used prokinetics for IBS are linaclotide (Linzess<sup>®</sup>) and lubiprostone (Amitiza<sup>®</sup>). Linaclotide is a guanylate cyclase C agonist that works by increasing intestinal fluid secretion and motility. It is dosed once daily. The most common side effect is diarrhea. Lubiprostone activates type 2 chloride channels increasing intestinal fluid secretion and motility. It is dosed twice daily. Most common side effects are nausea and diarrhea.<sup>8</sup>

Antispasmodic agents can also be used on an as-needed basis. Hyoscyamine (Levsin<sup>®</sup>) and dicyclomine (Bentyl<sup>®</sup>) are commonly used anticholinergic agents. These medications may help patients with postprandial abdominal pain and bloating. Common side effects of these medications are dry mouth, dizziness, and blurry vision. Peppermint oil, which also has antispasmodic properties, has been shown to improve symptoms of bloating and pain.<sup>17</sup>

Psychosocial factors may also contribute to the development and exacerbation of IBS. Patients with IBS report more stressful events than non-IBS patients. Anxiety, sleep disturbance and somatic symptoms are independent risk factors for the development of IBS. Antidepressants, most commonly tricyclic antidepressants (TCAs), may be used to treat IBS. Independent of their psychiatric benefits, TCAs also decrease transit time, the time it takes ingested food to pass through the GI tract.<sup>18</sup> Therefore, caution should be used when using TCAs in patients with predominant constipation. Selective serotonin reuptake inhibitors and selective serotonin-norepinephrine reuptake inhibitors have not yet been proven to improve IBS symptoms. There are many other medications used for the treatment of IBS, but this review article focuses on the treatment of bloating symptoms.

## SMALL INTESTINAL BACTERIAL OVERGROWTH (SIBO)

There is a diverse population of microflora in the intestinal tract. A disruption in this microbiome can cause overgrowth of bacteria. The human body defends itself against overgrowth with gastric acid secretion, intestinal mobility, the ileocecal valve, immunoglobulins, and bacteriostatic pancreatic and biliary secretions. SIBO syndrome is usually due to disorders of these protective mechanisms including achlorhydria (due to chronic atrophic gastritis or long-term PPI use) and pancreatic exocrine insufficiency. Small intestine obstruction secondary to adhesions, tumors, and strictures can cause slow bowel transit with stasis of feces leading to dysmicrobia. Crohn's disease patients may have loss of ileocecal valve secondary to prior resection. In short bowel syndrome, patients may also have loss of the ileocecal valve, allowing large intestinal bacteria to colonize into the small bowel. The connective tissue disease, scleroderma affects the GI tract in most patients, leading to pseudo-obstruction. Patients with diabetes mellitus may experience delayed gastric emptying due to gastroparesis causing SIBO.<sup>19</sup>

Common symptoms of mild SIBO include bloating, flatulence, abdominal pain, and diarrhea. A patient with the more severe disease might have malabsorption.<sup>19-20</sup> It is very important to consider SIBO as a diagnosis in all patients with motility disorders and abnormalities of the small bowel. Microbial testing of jejunal aspirates is the gold standard for diagnosis.<sup>19-20</sup> The most common bacteria found in SIBO are Streptococci, Bacteroides, Escherichia, and Lactobacillus.<sup>19</sup> Clinically significant SIBO is diagnosed when bacterial counts exceed 10,000 organisms/mL on jejunal aspirate throughout endoscopy.<sup>19</sup> Because this test is invasive, expensive, and the bacterial overgrowth could be missed during aspiration, this test is not commonly used.<sup>20</sup> The most commonly used testing is by a hydrogen and methane breath tests.<sup>20</sup> Carbohydrate fermentation by colonic bacteria is the only source of hydrogen and methane gas production in the human body. During this test, lactulose, glucose or xylose are administered to the patient. The patient is then asked to exhale into a tube and hydrogen or methane is measured. In patients with SIBO, there will be an early peak in breath hydrogen or methane levels because the carbohydrate administered will be metabolized in the small bowel by colonic bacteria producing these gases.

Treatment of SIBO should start with treating the underlying disease. Antibiotics should cover the bacteria that are associated with causing SIBO. Rifaximin is a commonly used antibiotic as it has low GI absorption and covers gram positive, gram negative, aerobic and anaerobic bacteria.<sup>19</sup> Other options for treatment are ciprofloxacin, amoxicillin-clavulanate, and metronidazole plus sulfamethoxazole/trimethoprim.<sup>20</sup>

## LACTOSE INTOLERANCE

Lactose intolerance occurs after ingestion of lactose in patients with lactase deficiency. When lactase is unavailable, lactose is not able to be digested and instead is fermented by bacteria in the colon. Common symptoms include abdominal pain, gas, bloating and diarrhea. Lactose intolerance is diagnosed by hydrogen breath testing and lactose ingestion.<sup>21</sup> The hydrogen breath test is more sensitive and specific than the lactose tolerance test and is widely available.

Acquired primary lactase deficiency is the most common cause of primary lactose malabsorption. At preschool age, most of the world's population begins to develop low intestinal levels of lactase. This is more common in Africans and Asians and less common in Caucasians. However, people who live in areas where cattle domestication has been a practice tend to better maintain their lactase levels.<sup>22</sup> Secondary lactose malabsorption is often caused by SIBO with increased fermentation of lactose in the small bowel leading to lactose intolerance symptoms. Many patients who self-diagnose themselves with lactose intolerance do not have impaired lactose digestion and many patients with impaired lactose digestion do not experience symptoms. Most patients with lactose intolerance can tolerate twelve grams of lactose (one cup of milk) in a single dose.<sup>23</sup>

Differentiating IBS from lactose intolerance is often difficult. These patients experience similar symptoms and patients with IBS often have hypersensitivity to lactose. 25% of patients with IBS also have defined lactase deficiency.<sup>24</sup> Either way, restriction of lactose in both groups may result in improvement of symptoms.

Dietary management is the first treatment for lactose intolerance. Patients may start with severe restriction and then work their way up to an amount of lactose they can handle. A total restriction is usually not necessary to avoid symptoms. Ice cream, yogurt and milk have high amounts of lactose, while cheese has lower lactose. Supplemental lactase enzymes, which are available over-the-counter, can be taken with food to help aid the digestion of lactose. These enzyme supplements cannot completely digest lactose and patients may still experience symptoms if lactose is ingested. In patients who avoid dairy, calcium and vitamin D should be supplemented and vitamin D levels should be monitored.<sup>23</sup>

## FRUCTOSE INTOLERANCE

Fructose is a monosaccharide and is also found combined with glucose to make the disaccharide-glucose. It is commonly found in commercial sweeteners as high fructose corn syrup. The average ingests 11 to 54 grams of fructose per day, however, most people cannot fully absorb a load of 25 grams. As in lactose malabsorption,

undigested fructose is digested by gut flora producing gas. Fructose intolerance is diagnosed by a fructose breath test.<sup>25</sup> Patients trying to avoid fructose should have a diet low in juices and fruits containing high net amounts of fructose-apples, pears, sweet cherries, prunes, dates, beverages sweetened with high fructose corn syrup, honey, and sorbitol containing gum and candy, as sorbitol can decrease fructose absorption.<sup>26</sup>

## CELIAC DISEASE

Celiac disease, also known as gluten-sensitive enteropathy is an autoimmune disorder of the small intestine. It is caused by a reaction to gluten, a component of wheat protein. Exposure to gluten will cause mucosal inflammation and villous atrophy. Commonly known as a disease diagnosed in infancy, it is now being diagnosed in patients from 10 to 40 years old. Classic symptoms of untreated celiac disease are steatorrhea and flatulence.<sup>27</sup> However, more patients with celiac disease are reporting more atypical symptoms similar to IBS including abdominal pain, bloating and distension.<sup>28</sup> Most patients present with no signs of disease, but some patients present with signs of malnutrition including weight loss, stomatitis and easy bruising.<sup>27</sup>

IgA anti-tissue transglutaminase antibody is the preferred test for detection of celiac disease.<sup>27</sup> Endomysial antibody testing has higher sensitivity and specificity, but is also more expensive.<sup>27</sup> Antigliadin antibodies are no longer recommended for initial testing because of their low sensitivity and specificity.<sup>27</sup> Patients with positive IgA anti-tissue transglutaminase antibody serology should undergo small bowel biopsy.<sup>27</sup> Patients with a wheat allergy, a diagnosis separate from celiac disease, will have negative IgA anti-tissue transglutaminase antibody serologies but positive IgE serology and skin prick test to wheat.<sup>29</sup> Symptoms of a wheat allergy can include nausea, vomiting, indigestion and bloating. Other common symptoms are hives, cough, sneezing, asthma and anaphylaxis that are not seen in celiac disease.

The mainstay of treatment for celiac disease is adherence to a gluten free diet.<sup>27</sup> Patients should avoid wheat, rye, barley, and most beers. Rice, tapioca, soy, corn, potatoes and wine are safe to eat. Many patients with celiac disease may also develop lactose intolerance but this can be reversed once the intestines heal with gluten restriction.<sup>27</sup>

## PROBIOTICS

Various studies have been performed that looked at the efficacy of probiotics in several gastrointestinal diseases. In IBS, multiple studies have shown that the probiotic *Bifidobacterium infantis* improves symptoms of IBS.<sup>30,31</sup> In a study that compared *Lactobacillus GG* to a low FODMAP diet in IBS, both were shown to aid in alleviation of symptoms.<sup>32</sup> *Lactobacillus GG* is sold under the brand name Culturelle®. In a study that compared *B. infantis* to both placebo and *Lactobacillus, B. infantis* was shown to be superior to both placebo and *Lactobacillus* in alleviating IBS symptoms.<sup>31</sup> *B. infantis* is sold under the brand name Align®. A systemic review of probiotics in lactose intolerance did not show improvement in symptoms.<sup>33</sup> Probiotics in SIBO may relieve symptoms of abdominal pain but have not been shown to decrease the incidence of SIBO.<sup>34</sup>

## OSTEOPATHIC MANIPULATIVE TREATMENT

Osteopathic manipulative treatment to the abdominal viscera is a useful way for primary care physicians to address abdominal bloating in the office. One commonly used technique for abdominal bloating and constipation is the mesenteric lift technique. The mesentery is the tissue that attaches the intestines to the abdominal wall. The goal of this technique is to improve blood flow and drainage of the vessels and lymphatics channels that course through the mesentery. This in turn will help restore normal intestinal motility. To perform this technique the patient lies supine with knees flexed. The physician places fingers medial to the anterior superior iliac spine (ASIS) and lifts the abdominal contents toward the umbilicus until a release is felt. This should then be repeated from the opposite lower quadrant. The physician should then apply traction from the left upper quadrant toward the umbilicus and then the right upper quadrant toward the umbilicus. Traction should be held until a release is felt.<sup>35</sup>

Another technique that can help with abdominal bloating is ganglion inhibition. The celiac ganglion, superior mesenteric ganglion, and inferior mesenteric ganglion carry sympathetic innervation to the intestines. This technique helps to normalize sympathetic innervation to the intestines. For this technique, the patient lies supine and the physician uses his fingers to apply pressure to the ganglion. The celiac ganglion is located inferior to the xyphoid process, inferior mesenteric ganglion under the umbilicus and just in between the two points is the superior mesenteric ganglion. Gentle pressure is applied by the physician's fingertips at all three points. As the patient exhales the physician allows his or her fingers to sink in, and while the patient inhales the physician resists. Pressure is held until a release is felt. This technique also helps to restore normal intestinal motility.<sup>36</sup>

## CONCLUSION

Normal intestinal gas production is caused by bacterial metabolism in the colon. Belching is a normal physiologic process that can be exacerbated by excessive air swallowing and GERD. Symptoms of bloating are often caused by impaired GI transit such as in constipation and IBS. Foods high in FODMAPs and high gas producing foods can also cause the sensation of bloating. Lastly, bacterial overgrowth and malabsorption syndromes can cause increased gas production in the intestines. Treating gas and bloating starts by treating the underlying cause. Severe symptoms of abdominal pain and bloating caused by intestinal gas can be debilitating for many patients. Proper diagnosis and treatment can help patients to live more normal lives.

## AUTHOR DISCLOSURES:

No relevant financial affiliations

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