

Small Intestinal Bacterial OverGrowth (SIBO)

Evelyn Pillor, DNP-C/PA-C

June 6, 2022



Disclosures

- None

Learning Objectives

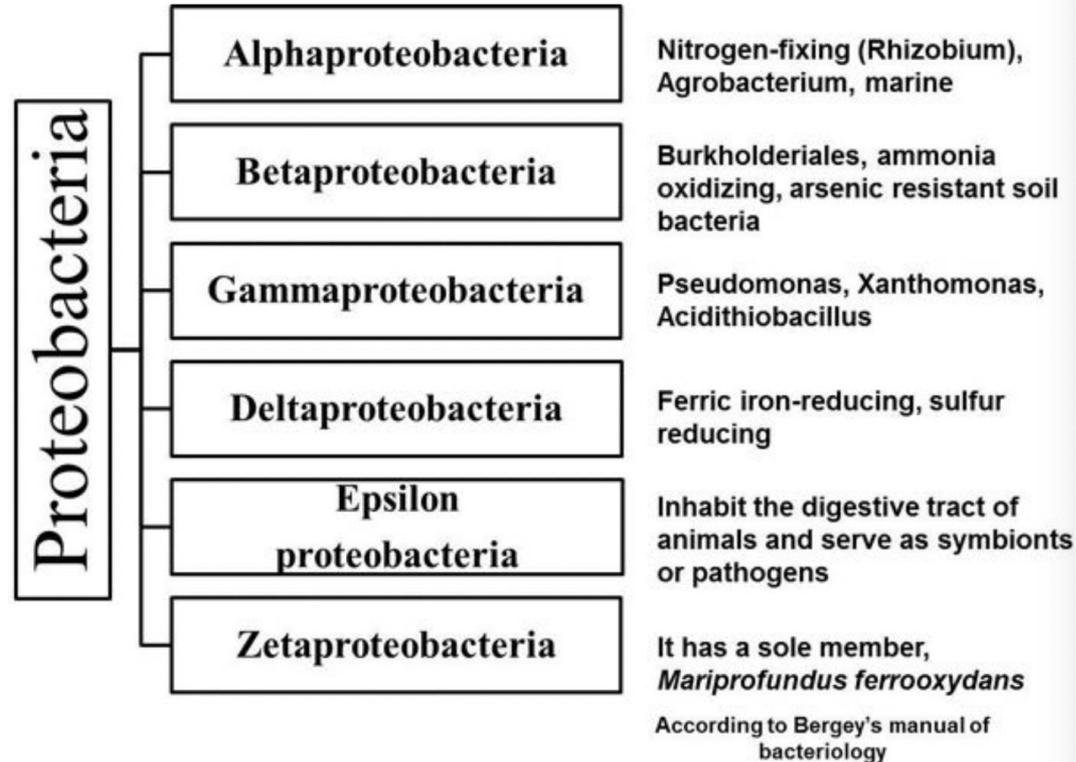
By the end of this presentation attendants will be able to:

- Define SIBO
- Describe ways to diagnose SIBO
- Discuss treatments
- Discuss future implications in diagnosis and treatment

Definition

- The most recent ACG guidelines define SIBO as the presence of excessive numbers of bacteria in the small bowel causing gastrointestinal symptoms
- The most common symptoms include abdominal pain, bloating, gas, distention, flatulence, and diarrhea
- These bacteria are usually coliforms, typically found in the colon, and include Gram-negative aerobic and anaerobic species that ferment carbohydrate-producing gas

Proteobacteria



The subgroups of proteobacteria and the main members of each subgroup.

Table 3. Mechanisms for maintaining small bowel ecological homeostasis

Mechanism	Rationale
Gastric acid	Most ingested bacteria in food cannot survive the acidic stomach.
Pancreatic enzymes	Digestive enzymes in the proximal small bowel may also digest bacterial products. Efficient digestion of nutrients leaves less substrates for bacteria.
Bile acids	As detergents, bile acids can have an effect on bacterial membranes.
Small bowel motility	Migrating motor complexes and other events cleanse the small intestine of debris during fasting.
IC valve	The IC valve protects the small bowel from retrograde movement of colonic flora into the small bowel.
Immune system	Mucosal immunity may be important in the maintenance of a stable microbiota of the intestinal lumen

IC, ileocecal.

Am J Gastroenterol. 2020. 00, 1-14.

SIBO and Gut Motility Syndromes

- SIBO has been linked to irritable bowel syndrome (IBS), Inflammatory Bowel Disease (IBD), Systemic sclerosis, Motility disorders, Cirrhosis, Fatty Liver Disease, Post-gastrectomy syndrome, Fibromyalgia, and Chronic Pancreatitis.
- Ninety percent (90%) of cases are caused by small intestinal dysmotility
- Chronic pancreatitis is a major risk factor due to changes in digestive enzymes that break down bacteria

Causes and Associated Diseases

Functional GI disorders: irritable bowel syndrome (IBS)

- 30% of IBS have SIBO

Dysmotility:

- Chronic intestinal pseudo-obstruction (CIPO)
- Narcotic use
- Radiation enteritis
- Scleroderma

Neuropathy: Diabetes

Small intestinal diverticulosis

Hypochlorhydria: atrophic gastritis, possible PPI use

Causes and Associated Diseases

Anatomy: Gastric bypass, lack of ileocecal valve

Changes to bile composition: Cirrhosis

Changes to enzyme secretion:

Chronic pancreatitis

Immunodeficiency: IgA deficiency

Diagnosis

Current diagnoses include:

- Duodenal/Jejunal aspirates

A positive SIBO test is defined as $>10^3$ colony forming units (CFU) per ml of aspirate

- Invasive, costly, increased risks
- Gold Standard for SIBO diagnosis

Diagnosis

- Hydrogen or Methane Breath Test
- Non-invasive and Less Expensive
- Fewer Risks when compared to the “gold standard”
- Patients drink a carbohydrate substrate like lactulose or glucose followed by a cup of water and breath hydrogen and methane are measured at 20-minute intervals for 180 minutes.
- A test is considered positive if there is a > 20 ppm increase in hydrogen and or > 10 ppm of methane concentration increase from baseline within 90 -120 minutes.
- Less reliability and validity than duodenal/jejunal aspirates.

Results

A positive Hydrogen (H_2) breath test is associated with irritable bowel syndrome with diarrhea (IBS-D) and irritable bowel syndrome mixed (IBS-M).

A positive Methane breath test is associated with IBS with constipation (IBS-C). Current guidelines have reclassified a positive methane breast test as Intestinal Methanogen Overgrowth (IMO)

Methane (CH_4) has been proven to slow down gut motility causing constipation in humans and animals alike.

Breath Test Examples

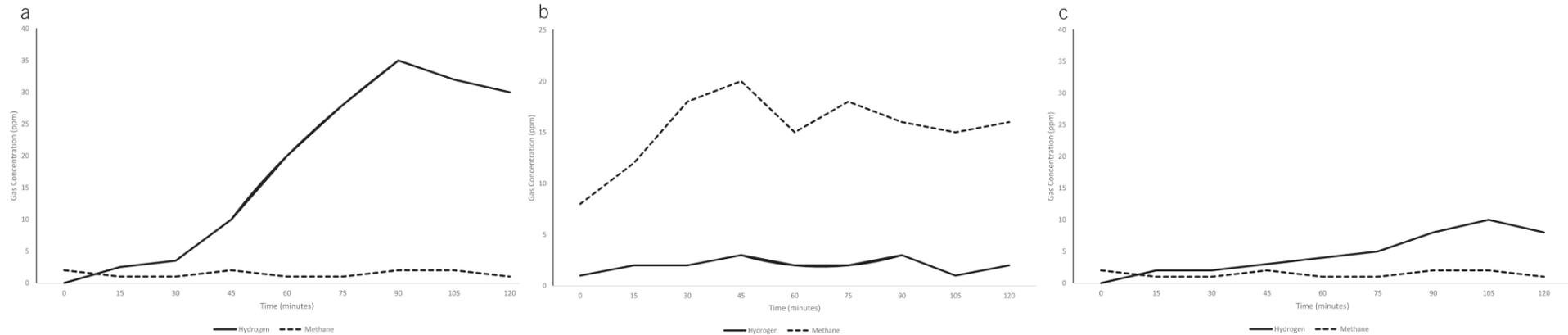


Figure 1. Breath test examples. (a) Hydrogen-positive breath test to suggest small intestinal bacterial overgrowth; (b) Methane-positive breath test to suggest intestinal methanogen overgrowth; (c) Normal breath test. ppm, parts per million.

Treatments

Treatments target the microbiome and include systemic and nonsystemic antibiotics. The only FDA non-systemic approved antibiotic for SIBO is Rifaximin.

Table 5. Suggested antibiotics for treatment of small intestinal bacterial overgrowth		
Antibiotic	Recommended dose	Efficacy
Nonabsorbable antibiotic		
Rifaximin	550 mg t.i.d.	61%–78%
Systemic antibiotic		
Amoxicillin-clavulanic acid	875 mg b.i.d.	50%
Ciprofloxacin	500 mg b.i.d.	43%–100%
Doxycycline	100 mg q.d. to b.i.d.	^a
Metronidazole	250 mg t.i.d.	43%–87%
Neomycin	500 mg b.i.d.	33%–55%
Norfloxacin	400 mg q.d.	30%–100%
Tetracycline	250. mg q.i.d.	87.5%
Trimethoprim-sulfamethoxazole	160 mg/800 mg b.i.d.	95%

^aIn the study, no testing performed to reassess small intestinal bacterial overgrowth, although all participants had other objective measures of improvement.

Am J Gastroenterol. 2020. 00, 1-14.

Treatments

Diet

- Reduction of fermentable products
- Temporary use of Low FODMAP with the slow reintroduction of foods to discern which cause increased symptoms
- No significant evidence to support pre-or probiotics

Gut-Directed Stress Management Techniques

Alternative Medicine and Herbal Medicines

Future Diagnostics

- **Intraluminal gas sampling with a telemetric capsule**

The concentration of oxygen allows the capsule to be accurately localized to the stomach, small intestine, or colon, while the concentrations of hydrogen and methane reflect microbial fermentation. Expected to be available in 2022.

The data can be sent via a handheld receiver and mobile app to the cloud, where it can be analyzed to gain insight into gastrointestinal disorders including small intestinal bacterial overgrowth (SIBO), irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), carbohydrate malabsorption and intolerance.

Future Diagnostics

- **Microbiomics and Metabolomics**

Future studies that utilize mucosal biopsies or small intestinal aspirates combined with next-generation sequencing and metabolomics will be key to understanding which microbes or metabolites are implicated in states of health and disease, including in IBS and SIBO

16S ribosomal RNA gene sequencing revealed lower diversity in patient's duodenum who had IBS compared to subjects without IBS. Sequencing has validated the diagnostic positivity of SIBO as $> 10^3$ CFU/ml of aspirate.

Questions



Thank You!!



References

- Brenner, D. (2020, September 18 – 2023, December 31)). Open-label assessment of the efficacy of Atrantil in the treatment of methane-predominant intestinal bacterial overgrowth. NCT04755673. <https://clinicaltrials.gov/ct2/show/NCT04755673>
- El Kurdi, B., Babar, S., El Iskandarani, M., Bataineh, A., Lerch, M., Young, M. M., & Singh, V. P. (2019). Factors that affect prevalence of small intestinal bacterial overgrowth in chronic pancreatitis: A systematic review, meta-analysis, and meta-regression. *Clinical and Translational Gastroenterology*, 10(9), e00072. <https://doi.org/10.14309/ctg.0000000000000072>
- Lauritano, E. C., Gabrielli, M., Scarpellini, E., Lupascu, A., Novi, M., Sottili, S., Vitale, G., Cesario, V., Serricchio, M., Cammarota, G., Gasbarrini, G., & Gasbarrini, A. (2008). Small intestinal bacterial overgrowth recurrence after antibiotic therapy. *The American journal of gastroenterology*, 103(8), 2031–2035. <https://doi.org/10.1111/j.1572-0241.2008.02030.x>
- Leite, G., Morales, W., Weitsman, S., Celly, S., Parodi, G., Mathur, R., Barlow, G. M., Sedighi, R., Millan, M., Rezaie, A., & Pimentel, M. (2020). The duodenal microbiome is altered in small intestinal bacterial overgrowth. *PloS one*, 15(7), e0234906. <https://doi.org/10.1371/journal.pone.0234906>
- Mailing, L. (2019, March 2016). *What the latest research reveals about SIBO*. <https://www.lucymailing.com/what-the-latest-research-reveals-about-sibo/>
- Pimentel, M., Saad, R.J., Long, M. D., Rao, S. S. C. (2020). ACG clinical guideline: Small intestinal bacterial overgrowth. *The American Journal of Gastroenterology*, 00, 1-14. <https://doi.org/10.14309/ajg.0000000000000501>.
- Plafsky, L., Barkin, J. A., Li, H., & Barkin, J. S. (2020). The relationship between serum IgA level, small intestinal bacterial overgrowth, and ethnicity. *The American Journal of Gastroenterology*, 115, S653. <https://doi.org/10.14309/01.ajg.0000707248.71927.7e>
- Sison, G. (2020). SIBO treatments and medications. *SingleCare*. <https://www.singlecare.com/conditions/sibo-treatment-and-medications>
- Sonu, I. (2021, November 5). *Bloating* [PowerPoint slides]. Division of Gastroenterology and Hepatology, Stanford University.

References

- Takakura, W., & Pimentel, M. (2020). Small intestinal bacterial overgrowth and irritable bowel syndrome- an update. *Frontiers in Psychiatry*.
<https://doi.org/10.3389/fpsyt.2020.00664>
- Verma, R., & Melcher, U. (2012). A support vector machine-based method to distinguish proteobacterial proteins from eukaryotic plant proteins. *BMC Bioinformatics*, 13(Suppl 15), S9.
<http://www.biomedcentral.com/1471-2105/13/S15/S9>