Small Intestinal Bacterial Overgrowth

Nutritional Implications, Diagnosis, and Management

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KEYWORDS

• Small intestinal bacterial overgrowth • Malabsorption • Breath test
• Small bowel aspirate • Antibiotic • Diagnosis • Treatment

KEY POINTS

- Small intestinal bacterial overgrowth (SIBO) is characterized by the presence of excessive bacteria in the small intestine.
- Small bowel motility is the most important protective mechanism preventing SIBO.
- Macronutrient and micronutrient deficiencies may occur as a consequence of SIBO.
- There is no true gold standard for the diagnosis of SIBO.
- It is important to identify and treat the underlying disorder causing SIBO.

INTRODUCTION

Over the last decade, small intestinal bacterial overgrowth (SIBO) has been suggested to be underrecognized and to have important clinical implications,[1] yet there remains no consensus on the definition of SIBO. This relates, in part, to a lack of a diagnostic gold standard and the nonspecific clinical manifestations attributed to SIBO. As a consequence, its true prevalence and relationship with other clinical disorders (ie, cause, consequence, or epiphenomenon) are unclear.[2] For similar reasons, the treatment of SIBO also presents a challenge, particularly in patients with relapsing symptoms and without classic risk factors for the development of SIBO.

Although traditionally considered a malabsorptive disorder associated with severe gut stasis, SIBO has more recently been suggested to be a less specific disorder associated with diverse clinical conditions (eg, irritable bowel syndrome [IBS], nonalcoholic

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fatty liver disease, and celiac disease) characterized by a variety of gastrointestinal and even nongastrointestinal symptoms thought to be related to the presence of excessive bacteria in the small intestine. Importantly, SIBO implies not only a quantitative assessment of bacteria but also the presence of particular species of bacteria in an atypical location in the small bowel. It is generally considered that only overgrowth of microbes that colonize the colon is clearly linked to clinically significant SIBO. As a corollary, if these microbes are reduced or eliminated from the small bowel, most commonly with antibiotics, then the clinical manifestations should resolve.

Reduced gastric acid production, deranged small bowel motility, altered bowel anatomy, and impaired systemic and/or local immunity are among the major intrinsic risk factors implicated in the development of SIBO. Although typically seen as a consequence of postsurgical stasis syndromes and profound intestinal dysmotility, SIBO is now considered by many investigators to result from less severe derangements in gut physiology. The objective of this article is to provide an up-to-date review of the nutritional implications, diagnosis, and management of SIBO. In the process, its risk factors and clinical manifestations are also discussed.

GUT MICROBES IN HEALTH

The gut microbiota of an infant is acquired from the mother during birth and, in the early stages of life, tends to be similar to that of the mother.[3,4] The diet and environment profoundly influence the composition of the gut microbiota during subsequent growth and development.[5] The commensal gut microbiota has multiple beneficial effects on the host, including the prevention of colonization by pathogenic bacteria, and maintenance of the integrity of intestinal epithelium and gut lymphoid tissue. In addition, certain gut microbes synthesize micronutrients such as vitamin K and folic acid, whereas others participate in drug metabolism.[6] Finally, colonic microbes are able to ferment undigested carbohydrates into short-chain fatty acids, which are used by colonocytes as an energy source and, in certain clinical scenarios (eg, short bowel syndrome), may be absorbed systemically and used as energy by the host.[6]

INTERNAL MECHANISMS REGULATING THE GUT MICROBIAL ECOSYSTEM

In the proximal small bowel of healthy individuals, gram-positive aerobic bacteria predominate with rare facultative anaerobes; together, these typically do not exceed more than 10^4 colony forming units (CFUs) per milliliter. In contrast, the distal small bowel acts as a transition zone with the microbiota in the small bowel consisting mostly of facultative anaerobes and sparse populations of aerobic bacteria, and the colon microbes consisting of a dense population of strict anaerobes; typically, greater than 10^{12} CFU/mL.[5]

SIBO may occur not only in the presence of excessive small bowel bacteria but also when there is an alteration in the distribution of the gut microbiota such that the microbes in the proximal small bowel reflect the usual microbes in the more distal gut. This typically is caused by a disturbance in factors normally preventing such alteration. The ileocecal valve has traditionally been considered important in regulating the composition of small intestine microbiota by preventing the reflux of colonic microbes into the small bowel. In support, a recent pilot study measured ileocecal valve pressures and found that individuals with a positive lactulose breath test for SIBO had defective ileocecal valve cecal distention reflex, which correlated with symptoms.[7] Additionally, Roland and colleagues[8] found that SIBO was more common in individuals with ileocecal valve dysfunction, as determined by impaired ileocecal junction pressures using a wireless motility capsule. In contrast, other studies suggest that