Small Intestinal Bacterial Overgrowth in Patients With Lower Gastrointestinal Symptoms and a History of Previous Abdominal Surgery

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Background: The small intestinal bacterial overgrowth (SIBO) breath test has had positive results in 84% of patients with irritable bowel syndrome vs 20% of controls. We hypothesized that SIBO would be more prevalent in patients with symptoms consistent with irritable bowel syndrome who have undergone previous abdominal surgery.

Objective: To identify causative factors for SIBO.

Design: Retrospective review.

Setting: Tertiary colorectal surgery clinic.

Main Outcome Measure: Result of SIBO breath test.

Results: We identified 77 patients whose differential diagnosis included SIBO from January 1, 2005, to December 31, 2007; 18 were excluded because of noncompliance with testing and 2 because of a decision to treat SIBO without formal testing. Symptoms were chronic abdominal pain in 30 patients (53%), bloating in 25 (44%), constipation in 37 (65%), and diarrhea in 7 (12%). Mean (SD) symptom duration was 45 (22) months. Of the 57 patients enrolled in this study, 45 (79%) tested positive for SIBO and 37 (82%) of those had a history of surgery, whereas 12 (21%) tested negative for SIBO and 9 (75%) of those had a history of surgery. Of the 36 SIBO-positive patients with a history of abdominal surgery (mean number of procedures, 2), the surgery locations were as follows: female reproductive organs, 23 (64%); hindgut, 15 (42%); foregut, 8 (22%); and midgut, 6 (17%). Open surgery alone was performed in 32 patients (56%) vs laparoscopic surgery in 7 (12%). Both open and laparoscopic procedures had been performed in 6 patients (11%). Four patients (7%) had a history of small intestinal obstruction. The mean age of SIBO-positive patients was higher than that of SIBO-negative patients (57 vs 44 years; \( P < .01 \)). Analysis did not reveal any clinically significant independent factor associated with SIBO.

Conclusion: Physicians should consider SIBO in the differential diagnosis of patients with normal anatomic findings and chronic lower gastrointestinal complaints.


SYMBIOTIC BACTERIA ARE NORMALLY COMPARTMENTALIZED TO THE DISTAL GUT, THANKS TO BOTH THE ILEOCECAL VALVE AND THE NORMAL INTERDIGESTIVE MOTILITY.1 WHEN THE ILEOCECAL VALVE IS COMPROMISED SECONDARY TO A MEDICAL DISEASE (EG, CELIAC, CROHN’S DISEASE, OR ULCERATIVE COLITIS) OR RESECTION, BACTERIA NORMALLY RESIDENT IN THE COLON CAN MIGRATE TO THE PROXIMAL GUT, WHICH IS STERILE IN HEALTHY INDIVIDUALS.1

THE UPPER LIMIT OF CONCENTRATION OF NORMAL INTESTINAL MICROFLORA IS APPROXIMATELY \( 1 \times 10^7 \) COLONY-FORMING UNITS/mL OF SMALL INTESTINAL ASPRASE 2-5. A HIGHER CONCENTRATION IS DEFINED AS SMALL INTESTINAL BACTERIAL OVERGROWTH (SIBO) 2-5 AND IMPLIES AN ABNORMAL COLONIZATION OF THE UPPER GUT AS A CONSEQUENCE OF A FAILURE OF DEFENSE MECHANISMS.6 THE PRESENCE OF ADHESIONS AFTER SURGERY MAY PLAY A ROLE IN STASIS AND CONTRIBUTE TO BACTERIAL OVERGROWTH.

THE CONDITION OF SIBO HAS BEEN ASSOCIATED WITH IRritable bowel syndrome (IBS) AND A VARIETY OF AUTONOMIC SYMPTOMS.4 THE SIBO BREATH TEST RELIES ON THE CONVERSION OF LACTULOSE TO METHANE AND/OR HYDROGEN BY BACTERIA IN THE SMALL INTESTINE (FIGURE 1), AND RESULTS ARE OFTEN POSITIVE IN PATIENTS WITH IBS. WE HYPOTHESIZED THAT SIBO WOULD BE MORE PREVALENT IN PATIENTS WITH IBS-LIKE SYMPTOMS WHO HAD UNDERGONE PREVIOUS ABDOMINAL SURGERY.

METHODS

After institutional review board approval, a tertiary colorectal surgery clinic database was used to retrospectively identify patients whose differential diagnosis included SIBO from January 1, 2005, to December 31, 2007. 18 patients were excluded because of noncompliance with testing and 2 because of a decision to treat SIBO without formal testing. Symptoms were chronic abdominal pain in 30 patients (53%), bloating in 25 (44%), constipation in 37 (65%), and diarrhea in 7 (12%). Mean (SD) symptom duration was 45 (22) months. Of the 57 patients enrolled in this study, 45 (79%) tested positive for SIBO and 37 (82%) of those had a history of surgery, whereas 12 (21%) tested negative for SIBO and 9 (75%) of those had a history of surgery. Of the 36 SIBO-positive patients with a history of abdominal surgery (mean number of procedures, 2), the surgery locations were as follows: female reproductive organs, 23 (64%); hindgut, 15 (42%); foregut, 8 (22%); and midgut, 6 (17%). Open surgery alone was performed in 32 patients (56%) vs laparoscopic surgery in 7 (12%). Both open and laparoscopic procedures had been performed in 6 patients (11%). Four patients (7%) had a history of small intestinal obstruction. The mean age of SIBO-positive patients was higher than that of SIBO-negative patients (57 vs 44 years; \( P < .01 \)). Analysis did not reveal any clinically significant independent factor associated with SIBO.

Conclusion: Physicians should consider SIBO in the differential diagnosis of patients with normal anatomic findings and chronic lower gastrointestinal complaints.


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January 1, 2005, to December 31, 2007. Patient data recorded included demographic characteristics, medical and surgical history, presenting symptoms, diagnostic evaluations including breath test, and treatment. Data from follow-up visits were also recorded. Patients who were SIBO positive were compared with SIBO-negative patients in a case-control fashion. Pediatric patients were not included in this study.

**DATA ANALYSIS**

Differences in means were assessed using the Wilcoxon rank-sum test. Differences in proportions were assessed using the χ² test. Statistical significance was set at P < .05. Multiple regression analysis was performed to identify causative factors for SIBO. All statistical analysis was performed using SAS software, version 9.1 (SAS Institute, Inc, Cary, North Carolina).

**ANTIBIOTIC TREATMENT**

Patients with SIBO were treated with a 2-week course of antibiotics (rifaximin). Patients were reassessed after treatment.

**RESULTS**

During the 36-month period of this study (January 1, 2005, to December 31, 2007), a total of 77 patients who underwent the breath test for SIBO were identified at the Division of Colorectal & Pelvic Floor Surgery, Department of Surgery, University of Southern California University Hospital (Los Angeles). Of those 77 patients, 18 were excluded because of noncompliance with testing and 2 were excluded because of a decision to treat them for SIBO without formal testing.

Of the remaining 57 patients, 50 (88%) were female and 7 (12%) were male. The mean (SD) age was 54 (16) years (range, 17-91 years), and the mean (SD) weight was 151 (31) lb (range, 93-264 lb). Most (82%) of these patients were white; 14% were Hispanic.

The most common presenting symptoms were constipation in 37 patients (65%), chronic abdominal pain in 30 (53%), bloating in 25 (44%), and diarrhea in 7 (12%). The mean (SD) symptom duration was 45 (22) months.

Of the 57 patients enrolled in this study, 45 (79%) tested positive for SIBO and 37 (82%) of those had a history of surgery, whereas 12 (21%) tested negative for SIBO and 9 (75%) of those had a history of surgery (Figure 2). The mean age of SIBO-positive patients was higher than that of SIBO-negative patients (57 vs 44 years; P < .01). Symptoms resolved in 22 patients (49%) treated with gastrointestinal tract antibiotics.

Of the 36 SIBO-positive patients with a history of abdominal surgery (mean number of procedures, 2), the surgery locations were as follows: female reproductive organs, 23 (64%); hindgut, 15 (42%); foregut, 8 (22%); and midgut, 6 (17%). Open surgery alone was performed in 32 patients (56%) vs laparoscopic surgery in 7 (12%). Both open and laparoscopic procedures had been performed in 6 patients (11%). Four patients (7%) had a history of small intestinal obstruction.

Logistic regression analysis did not reveal any clinically significant independent factor associated with SIBO.

**COMMENT**

Two types of bacterial overgrowth can be differentiated: gastric overgrowth with upper respiratory tract microflora due to failure of the gastric acid barrier, mainly caused by *Helicobacter pylori*, and intestinal overgrowth due to failure of the intestinal clearance as a result of impaired intestinal peristalsis or anatomical abnormalities, caused by gram-negative bacilli. The distribution depends on the type of failure, and unless specified, the term bacterial overgrowth refers to SIBO.

Endoscopy provides an accurate means to identify abnormalities of the gastrointestinal tract, but it is invasive and expensive and has risks of complications. Culture of intestinal contents is the ideal method for detecting bacterial overgrowth and allows identification of both types of bacterial overgrowth, but the labor and cost involved make its clinical use difficult. Furthermore, the problem with the direct approach is the access. Although bacterial overgrowth can occur only in the more distal portions of the small intestine, direct aspiration and culture are limited by the reach of the endoscope (approximately 60 cm). As a result, the detection of bacterial overgrowth by endoscopy is considerably less prevalent than such detection by breath tests.

With regard to indirect tests, the ¹³C- or ¹⁴C- dl-xylose or lactulose breath test and the glucose, lactose, or lactulose hydrogen breath tests are available. The carbohydrate breath tests are used to diagnose carbohydrate malabsorption and to identify patients with SIBO in a simple, noninvasive, and less expensive way, and they can provide the desired information.

A variety of results have been used as a positive finding, including the presence of a “double peak,” the first peak corresponding to lactulose metabolized by small intestinal bacteria and the second peak corresponding to lactulose reaching the cecum. Saad and Chey assume that the presence of a common single peak can be either the result of fermentation in the small bowel, in the case of SIBO, or simply colonic fermentation, which can happen in patients with IBS and diarrhea who have accelerated ileocecal transit, resulting in a false-positive breath test.
Lately, Lupascu et al11 and Nucera et al12 have shown an interest in the overlap of SIBO and IBS. Causes of IBS are still unknown, but it has been hypothesized that there is a dysregulation of visceral function and a strong association with emotional factors and stress.13 Specific intestinal microbes have been reported to contribute to the onset of IBS.14-16

Small intestinal bacterial overgrowth is common in a colorectal surgery population presenting with lower gastrointestinal complaints. The clinical significance of SIBO is the chronic presence of pain, bloating, diarrhea, and malabsorption, similar to the symptoms seen in IBS patients17 and in the patient population of this study.

Previous studies in which the prevalence of SIBO in IBS patients was investigated gave contradictory results.18-20 Different criteria for IBS and different breath tests may account for the discrepancies in the prevalence of SIBO.11

In a comprehensive study, Lupascu et al11 reported positive breath test results in 31% of IBS patients and 4% of healthy subjects. This difference was statistically significant, suggesting an epidemiologic association between SIBO and IBS. Recently, Lin21 reported that SIBO was found in 78% to 84% of patients with common symptoms of IBS.

With regard to the physiology of symptoms of SIBO and IBS, it has been proposed that in SIBO patients, there is an abnormal production of gases localized in the small intestine, which could explain the bloating and abdominal pain.22 Sugar malabsorption with increased carbohydrate fermentation, organic acid production, and bowel pH reduction may play a role in other symptoms, such as diarrhea.12

A known complication of SIBO, bacterial translocation,23 is the movement of gut bacteria from the lumen across the mucosal barrier,24 which can lead to the appearance of gut bacteria in the mesenteric lymph nodes and visceral organs, as demonstrated experimentally in rats.25 A potentially important consequence of the bacterial translocation is the immune response activation. Bacterial translocation and the production of lipopolysaccharide by gram-negative bacteria might explain the abnormal motility and visceral hypersensitivity present in the IBS patients26-28 and could be related to other immune-mediated disorders, such as fibromyalgia, interstitial cystitis, and chronic fatigue syndrome.29-32

In an attempt to reestablish the normal gut ecology, SIBO patients are often treated with cultures of beneficial species of enteric bacteria known as probiotics.1 However, this approach is limited because the number and distribution of species of the gut are still unknown.1 Among the strategies proposed for the normalization of symptoms are an elemental diet for 2 weeks,33 a 10-day course of traditional systemic antibiotics,34 and a 10-day course of nonabsorbable antibiotics. The success of these therapies ranges from 5% to 80%.1

Antibiotics can modulate the abnormal microflora. Rifaximin was the drug used in our study. This rifamycin derivative was effective in the treatment of SIBO35 because it has effects on intestinal anaerobic and facultative bacteria along the entire small intestine36 and is a poorly absorbed antibiotic.37

Although a history of abdominal and pelvic surgery in the patient population of this study was not associated with a statistically higher prevalence of SIBO, the prevalence of positive SIBO breath test results was greater than historical control rates. In our study, most (82%) patients who tested positive for SIBO had a history of surgery. The presence of adhesions as a result of surgical procedures and the potential for intestinal stasis may play an important role in the onset and maintenance of SIBO.

This study is limited by the retrospective design and the small number of subjects enrolled, and further study is needed to assess the risk of SIBO after abdominal and pelvic surgery. However, SIBO should be considered in the differential diagnosis of patients with normal anatomic findings and chronic lower gastrointestinal complaints.

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Author Contributions: Drs Petrone and Kaufman had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data.

Previous Presentation: The results of this study were presented at the 49th Annual Meeting of the Society for Surgery of the Alimentary Tract; May 20, 2008; San Diego, California.

REFERENCES