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Small intestinal bacterial overgrowth (SIBO) in individuals without and with risk factors

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Abstract

Background: SIBO is increasingly being diagnosed in clinical practice in patients with a variety of gastrointestinal symptoms such as flatulence, bloating and diarrhea. There are various risk factors for the development of SIBO including altered small bowel anatomy (gastric resection, Biliroth II surgery, Roux- en-Y anastomosis, jejunoileal bypass surgery, surgically created blind loop, fistula between proximal and distal bowel, small bowel stricture, resection of ileocecal valve), altered small bowel motility (due to diabetic autonomic neuropathy, cirrhosis of liver, acute necrotizing pancreatitis or chronic pancreatitis, scleroderma, polymyositis, intestinal pseudoobstruction, celiac disease, irritable bowel syndrome), small bowel diverticulosis, chronic renal failure, immunodeficiency states, hypochlorhydria, recurrent antibiotics, chronic alcoholics, diabetes mellitus and old age. There are also a subset of patients without previously defined symptoms that develop SIBO.

Purpose: To define what risk factors may predispose patients to developing SIBO and to find out whether symptomatic patients with risk factors have greater chance of developing SIBO than symptomatic patients without any risk factor for SIBO.

Methods: Retrospective study with review of electronic medical records from a University Hospital System in Philadelphia from July 1, 2015 to June 30, 2016. All symptomatic patients (gas, bloating, diarrhea, constipation, abdominal pain, belching, halitosis) above the age of 18, irrespective of sex and race who had lactulose breath test during that period were included in our study. Patients with repeat breath tests after treatment were excluded from the study. The study data was analyzed in Microsoft Excel.

Result: 434 patients underwent a lactulose breath test. The number of positive tests was 344 (79.26%) and total negative test was 90 (20.74%). 232 patients had previously defined risk factors (RF) and some of them had multiple RF and out of them 182 (78.45%) had a positive test (Table 2). Patients without risk factors were 202 and out of them 162 (80%) had positive test. Demographics of these two groups are shown in Table 1. To compare the breath test results between the two groups, Z test was done and Z score was found to be -0.4485 (P value 0.32636) indicating that there was no significant difference between the results.

Conclusion: Although there are known risk factors for the development of SIBO, symptomatic patients can have SIBO even without any risk factor. About 50% of the patients with risk factors had IBS. The next common risk factors were diabetes mellitus, old age >75 years and Celiac disease. Irrespective of the risk factors, SIBO should be ruled out if the patients are symptomatic.

Introduction

Small Intestine Bacterial Overgrowth (SIBO) is increasingly being diagnosed and presents in clinical practice with a variety of gastrointestinal symptoms including flatulence, bloating and diarrhea. SIBO is characterized by an excessive and/or abnormal population of bacteria in the small intestine (1). Normally, the upper small intestine contains <103 organisms/ml but when the bacterial population exceeds 105 – 106 organisms/ml, we call it SIBO. Normal small intestinal cultures contain gram positive aerobic species or facultative anaerobes, but in SIBO colonic-type bacteria such as Streptococcus, Escherichia coli, Staphylococcus, Bacteriodes, and Klebsiella are found (2). Both the increase in the amount of bacteria in the small intestine and the presence of abnormal bacteria lead to the symptoms of SIBO. These bacteria in the small intestine can produce toxins that can damage the mucosa disrupting the absorptive function, metabolize bile acids leading to fat malabsorption, and preferentially metabolize carbohydrates to short chain fatty acids causing bloating (3). Furthermore, simply an increase in the amount of bacteria in the small intestine can lead to villous blunting and epithelial inflammation contributing to the observed symptoms (4).

Protective factors against SIBO include antimicrobial barriers such as gastric acid, immune function, pancreatic exocrine enzymes, proper bowel motility, and an intact ileocecal valve. Risk factors for SIBO include conditions that disrupt these defenses including altered small bowel anatomy (gastric resection, Biliroth II surgery, Roux- en-Y anastomosis, jejunoileal bypass surgery, surgically created blind loop, fistula between proximal and distal bowel, small bowel stricture, resection of ileocecal valve), altered small bowel motility (due to diabetic autonomic neuropathy, cirrhosis of liver, acute necrotizing pancreatitis or chronic pancreatitis, systemic sclerosis, polymyositis, intestinal pseudoobstruction, celiac disease, irritable bowel syndrome), small bowel diverticulosis, chronic renal failure, immunodeficiency states, hypochlorhydria, recurrent use of antibiotics, chronic alcoholics, diabetes mellitus and old age (5-8).

The prevalence of SIBO is widely unknown due to imperfection of unreliable diagnostic testing, improper diagnosis due to overlap of symptoms with other gastrointestinal disorders, and underreporting due to failure to seek treatment. However,

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various studies using healthy people as controls have reported the prevalence in the population between 4 and 20% (5-8). Many studies have been performed looking at prevalence of SIBO in variousgastrointestinal disorders. One metanalysis studying the prevalence of SIBO in patients with IBS concluded that it can vary between 4% to 54% depending on the diagnostic test used (9), while others have concluded this could be as high as 84% (10). Although much heterogeneity exists, motility disorders seem to account for the majority of cases.Although the prevalence of SIBO is increasingly being studied in patients with known risk factors, little research has been done studying SIBO in symptomatic patients without risk factors. Even without risk factors, it is known that SIBO can contribute to common GI complaints as demonstrated in one study investigating carbohydrate malabsorption in symptomatic, otherwise healthy volunteers found 88/460 patients with results indicative of SIBO (11). It is important to properly diagnose SIBO due to relief of more mild GI complaints as well as more serious malabsorptive issues that can lead to vitamin deficiencies (vitamin B12 deficiency due to bacterial utilization, vitamin A, D, E, K deficiency through fat malabsorption) and anemia (12). Furthermore, due to its overlapping symptoms with many other gastrointestinal disorders, SIBO is widely misdiagnosed leading to unnecessary and/or improper treatment for patients (13). The purpose of this study is to define what risk factors may predispose patients to developing SIBO and to find out whether symptomatic patients with risk factors have greater chance of developing SIBO than symptomatic patients without any risk factor for SIBO.

Methods

We performed a retrospective study with review of electronic medical records from a University Hospital System in Philadelphia from July 1, 2015 to June 30, 2016. All symptomatic patients (gas, bloating, diarrhea, constipation, abdominal pain, belching, halitosis) above the age of 18, irrespective of sex and race who had lactulose breath test during that period were included in our study. Patients with repeat breath tests after treatment were excluded from the study. The study data was analyzed in Microsoft Excel.

Results

A total of 434 patients underwent a lactulose breath test. The average age of patients with previously defined risk factors was 51.88, and the average age of patients without previously defined risk factors was 49.39. The majority of patients were female and Caucasian with 68% and 79% respectively in the group with previously defined risk factors and 80% and 71% respectively in the group without previously defined risk factors. Other demographics are displayed in Table 1. The number of positive tests was 344 (79.26%) and total negative test was 90 (20.74%). 232 patients had previously defined risk factors (RF) (some of whom had multiple risk factors) and out of them 182 (78.45%) had a positive test (Table 2). Of the risk factors investigated, IBS was most commonly associated with a positive breath test accounting for over 50% of patients with risk factors with positive test results. The next most common risk factors with a positive breath test results were old age, diabetes, and celiac disease with a positive test 9%, 9%, and 8% of the time respectively. Chronic steroid use, common variable immunodeficiency, gunshot wound, HIV, and small bowel diverticuli were least associated with a positive breath test (0.5% each) (Table 2). Patients without risk factors were 202 and out of them 162 (80%) had positive test. To compare the breath test results between the two groups, Z test was done and Z score was found to be -0.4485 (P value 0.32636) indicating that there was no significant difference between the results.

Discussion

In this study, a total of 78% of participants who had previously defined risk factors for SIBO had a positive lactulose breath test. This value correlates with Corrazza etal., that reported the prevalence of SIBO in symptomatic patients with previously defined risk factors as 74% as evaluated through jejunal aspirate, which is the gold standard for diagnosis (14). However, this value for prevalence varies significantly depending on several factors, including the type of test used. Although jejunal aspirate is the gold standard, it is an invasive test, and even with this test, variability exists depending on the exact site of bacterial sampling (14). Advantages to breath testing include ease of administration and non-invasive nature of the test. However, differences in sensitivity and specificity exist between both breath testing and jejunal aspirates as well as between the two main types of hydrogen breath testing: glucose and lactulose. One study compared information obtained from jejunal aspirates to that from glucose and lactulose breath testing results to determine the sensitivity and specificity of breath testing for detecting SIBO. They found that glucose breath testing has a sensitivity and specificity of 40% and 80%, respectively, whereas lactulose breath testing had a sensitivity and specificity of 31% and 86%, respectively (15). There are many reasons to explain the lower sensitivity of these testing, including the colonization of bacteria that do not produce hydrogen but instead other gasses, including methane and hydrogen sulfide (16). However, it is important to note that the specificities of these breath tests are relatively high and often underestimate SIBO.

Our study found that of those participants with previously defined risk factors who tested positive for SIBO, patients with IBS made up the highest proportion of positive tests at over 50%. The next most common risk factors were diabetes mellitus and old age, each accounting for over 9% of positive tests (table 2). As previously mentioned, many studies have attempted to quantify the prevalence of SIBO in IBS patients. Still, much discordance exists, and values have been reported from between 4% and 54% to as high as 84% (9,10). Although the pathogenesis for this association is not known, many different mechanisms have been proposed, including abnormalities in the migrating motor complex or delayed or abnormal transit and motility (17, 18). The prevalence and pathogenesis of SIBO in diabetes mellitus and old age have been studied as well. One study found that in

diabetic patients with chronic diarrhea, 43% tested positive for SIBO, while another study found that as many as 75% of diabetic patients with abnormal carbohydrate absorption on an oral glucose tolerance test were positive for SIBO. The pathogenesis is thought to be due to altered motility (19, 20). The prevalence of SIBO in old age seems to be slightly less than those with diabetes. A study by Parlesak etal., looking at healthy adults above 61 years noted SIBO in 15.6% of participants (21). This pathogenesis seems to be more complicated and related to medications and comorbid conditions such as diabetes that alter gut motility.

As previously mentioned, few studies have looked at the prevalence of SIBO in patients with symptoms but without known risk factors. Studies using healthy asymptomatic controls detected SIBO between 4% and 20% of the time using primarily breath testing. While others using jejunal aspirates found the prevalence in healthy controls as low as 0% (22). One study evaluated patients with symptoms but without risk factors detected SIBO in 32% of these patients using jejunal aspirate (14). Our study identified the presence of SIBO in 80% of healthy participants without known risk factors for SIBO, but who noted common symptoms of SIBO. Some limitations of this study include the use of only lactulose breath testing to determine the presence of SIBO in participants, as well as this being a single center study. Future investigations can use both glucose breath testing and jejunal aspirates in healthy, symptomatic patients without risk factors and compare detection sensitivity and specificity to lactulose breath testing. Studies can also be performed culturing the bacteria in patients who are symptomatic with risk factors versus those symptomatic without risk factors to determine if different bacteria colonize these groups of patients diagnosed with SIBO. Future studies could also look at which symptoms, in particular, are more sensitive and specific to predicting SIBO in patients with and without risk factors. In conclusion, this study found that SIBO can be detected and diagnosed in patients with symptoms, even without any risk factors. This is an important diagnostic consideration because the symptoms for SIBO overlap with many other common gastrointestinal disorders, and prompt detection and treatment of SIBO can save patients from more invasive and unnecessary testing and treatment. Therefore, SIBO should be suspected in all symptomatic patients irrespective of the presence of risk factors.

References

1. Bures J, Cyrany J, Kohoutova D, Förstl M, Rejchrt S, Kvetina J, etal., Small intestinal bacterial overgrowth syndrome. World J Gastroenterol. 2010;16(24): 2978–2990. Doi: 10.3748/wjg.v16.i24.2978
2. Bouhnik Y, Alain S, Attar A, Flourié B, Raskine L., Sanson-Le Pors, etal., Bacterial Populations Contaminating the Upper Gut in Patients with Small Intestinal Bacterial Overgrowth Syndrome. American Journal of Gastroenterology.1999; 94(5): 1327-1331.doi: 10.1111/j.1572-0241.1999.01016.x
3. Dukowicz AC, Lacy BE, Levine GM. Small intestinal bacterial overgrowth: a comprehensive review. Gastroenterol Hepatol (N Y). 2007;3(2); 112–122.
4. Greenson J. The biopsy pathology of non-coeliac enteropathy. Histopathology. 2015; 66(1): 29-36.doi: 10.1111/his.12522
5. Choung R, Ruff K, Malhotra A, Herrick L, Locke G, Harmsen W, etal., Clinical predictors of small intestinal bacterial overgrowth by duodenal aspirate culture. Alimentary Pharmacology & Therapeutics. 2019; 33(9): 1059-1067.doi: 10.1111/j.1365-2036.2011.04625.x
6. Lupascu A, Gabrielli M, Lauritano E, Scarpellini E, Santoliquido A, Cammarota G., etal., Hydrogen glucose breath test to detect small intestinal bacterial overgrowth: a prevalence case-control study in irritable bowel syndrome. Alimentary Pharmacology and Therapeutics. 2005; 22(11-12): 1157-1160. doi:10.1111/j.1365-2036.2005.02690.x
7. Pimentel, M., Chow, E. and Lin, H. Normalization of lactulose breath testing correlates with symptom improvement in irritable bowel syndrome: a double-blind, randomized, placebo-controlled study. The American Journal of Gastroenterology. 2003; 98(2): 412-419.doi: 10.1111/j.1572-0241.2003.07234.x
8. Pimentel M, Wallace D, Hallegua D, Chow E, Kong Y, Park S, et al., A link between irritable bowel syndrome and fibromyalgia may be related to findings on lactulose breath testing. Ann Rheum Dis. 2004;63(4):450–452.doi: 10.1136/ard.2003.011502
9. Ford A, Talley N, Spiegel B. and Moayyedi P. Small Intestinal Bacterial Overgrowth in Irritable Bowel Syndrome: Systematic Review and Meta-Analysis. Gastroenterology. 2009; 7(12): 1279-1286. doi: 10.1016/j.cgh.2009.06.031
10. Lin H. Small Intestinal Bacterial Overgrowth: a framework for understanding irritable bowel syndrome. JAMA. 2004; 292(7): 852-858. doi:10.1001/jama.292.7.852
11. Goebel-Stengel M, Stengel A, Schmidtmann M, Voort I, Kobelt P and Mönnikes H. Unclear Abdominal Discomfort: Pivotal Role of Carbohydrate Malabsorption. Journal of Neurogastroenterology and Motility.2014; 20(2): 228-235. doi: 10.5056/jnm.2014.20.2.228
12. Gasbarrini A, Lauritano E, Gabrielli M, Scarpellini E, Lupascu A, Ojetti V etal., Small Intestinal Bacterial Overgrowth: Diagnosis and Treatment. Digestive Diseases. 2007; 25(3): 237-240. doi: 10.1159/000103892
13. Pimentel M, Chow E and Lin H. Eradication of small intestinal bacterial overgrowth reduces symptoms of irritable bowel syndrome. The American Journal of Gastroenterology. 2000; 95(12): 3503-3506. doi: 10.1111/j.1572-0241.2000.03368.x
14. Corazza G, Menozzi M, Strocchi A, Rasciti L, Vaira D, Lecchini R, etal., The diagnosis of small bowel bacterial overgrowth. Reliability of jejunal culture and inadequacy of breath hydrogen testing. Gastroenterology.1990; 98(2): 302–309. doi: 10.1016/0016-5085(90)90818-l
15. Ghoshal U, Ghoshal U, Das K and Misra A. Utility of hydrogen breath tests in diagnosis of small intestinal bacterial overgrowth in malabsorption syndrome and its relationship with oro-cecal transit time. Indian J Gastroenterol.2006; 25(1): 6-10.
16. Ghoshal UC. How to interpret hydrogen breath tests. J Neurogastroenterol Motil. 2011; 17(3): 312–317. doi: 10.5056/jnm.2011.17.3.312
17. Pimentel M, Soffer E, Chow E, Kong Y and Lin H. Lower frequency of MMC is found in IBS subjects with abnormal lactulose breath test, suggesting bacterial overgrowth. Dig Dis Sci. 2002; 47(12): 2639-

2643. doi: 10.1023/a:1021039032413

18. McLoughlin G, Hede J, Temple J, Bradley J, Chapman D. and McFarland J. The role of IgA in the prevention of bacterial colonization of the jejunum in the vagotomized subject. British Journal of Surgery. 1978; 65(6): 435-437. doi: 10.1002/bjs.1800650619
19. Virally-Monod M, Tielmans D, Kevorkian J, Bouhnik Y, Flourie B, Porokhov B, etal., Chronic diarrhoea and diabetes mellitus: prevalence of small intestinal bacterial overgrowth. Diabetes Metab.1998; 24(6): 530-536.
20. Urita, Y, Ishihara S, Akimoto T, Kato H, Hara N, Honda Y, etal., Seventy-five gram glucose tolerance test to assess carbohydrate malabsorption and small bowel bacterial overgrowth. World Journal of Gastroenterology.2006; 12(19): 3092-3095. doi: 10.3748/wjg.v12.i19.3092
21. Parlesak A, Klein B, Schecher K, Bode J. and Bode C. Prevalence of Small Bowel Bacterial Overgrowth and Its Association with Nutrition Intake in Nonhospitalized Older Adults. Journal of the American Geriatrics Society,2003; 51(6): 768-773. doi: 10.1046/j.1365-2389.2003.51259.x
22. Teo M, Chung S, Chitti L, Tran C, Kritas S, Butler R. and Cummins A. Small bowel bacterial overgrowth is a common cause of chronic diarrhea. Journal of Gastroenterology and Hepatology. 2004;19(8): 904-909. doi: 10.1111/j.1440-1746.2004.03376.x