



# Interpreting the Lactulose Breath Test for the Diagnosis of Small Intestinal Bacterial Overgrowth



Joseph K. Sunny Jr., MD, Cesar J. Garcia, MD  
and Richard W. McCallum, MD

## ABSTRACT

**Introduction:** Based on literature review, a positive lactulose breath test (LBT) for small intestinal bacterial overgrowth requires an initial peak value of hydrogen within 100 minutes of lactulose ingestion with a second peak before 180 minutes. However, using scintigraphic monitoring of lactulose transit time, mean oral-cecal arrival time has been reported as 73 minutes. The goal was to propose new criteria for analysing the LBT to overcome false positive interpretations.

**Methods:** LBTs from our referral center were interpreted as positive after ingestion of 10 g of lactulose using the following approach for hydrogen concentrations: (1) *The literature guidelines:* greater than 20 ppm from a baseline less than 10 ppm achieved within 100 minutes followed by a further rise of greater than 15 ppm within 180 minutes. (2) *The proposed criteria:* greater than 20 ppm from a baseline less than 10 ppm within either 60 or 80 minutes followed by a further rise of greater than 15 ppm during the 180-minute test.

**Results:** A total of 153 patients with symptoms suspicious for small-bowel bacterial overgrowth underwent testing. Of all, 26.1% patients tested positive by 100 minutes, 11.8% patients tested positive by 60 minutes and 18.3% patients tested positive by 80 minutes. The percentage of positive LBTs at 60 and 80 minutes was significantly lesser than for the 100 minutes criteria ( $P < 0.05$ ).

**Conclusions:** The first hydrogen peak increase should occur by either 60 or 80 minutes to increase the specificity of LBT for small intestinal bacterial overgrowth based on the reality of lactulose cecal arrival times.

**Key Indexing Terms:** Lactulose breath test; Small intestinal bacterial overgrowth; Bloating; Diarrhea. [*Am J Med Sci* 2016;351(3):229–232.]

## INTRODUCTION

The gastrointestinal tract has a complex population of symbiotic microbes called microbiota. Variable quantities exist along the tract from  $10^1$ - $10^3$  bacteria per gram of luminal secretions in the stomach and duodenum to  $10^{11}$ - $10^{12}$  bacteria per gram in the colon. Small intestinal bacterial overgrowth (SIBO) is defined as greater than  $10^5$  colony forming units of bacteria per milliliter of luminal fluid from the proximal jejunum, including anaerobic and aerobic cultures.<sup>1</sup> More recently, a study investigated both the culturing of jejunal aspirates and polymerase chain reaction (PCR) analysis. The sensitivity and specificity of the breath test using PCR as a measure of bacterial counts was 55.00% and 0.0%, respectively with a positive predictive value of 100%. The sensitivity and specificity of the breath test using bacterial culture of jejunal aspirate was 45.45% and 33.33%, respectively with a positive predictive value of 44.45%. Clearly many bacteria are not able to be cultured by standard aerobic and anaerobic techniques and based on PCR of jejunal aspirates, essentially all patients with gas, bloating and abdominal bloating had  $> 10^5$  organisms/mL of bacteria.<sup>2</sup>

As collecting aspirates from the jejunum requires an endoscopic procedure and culture methods, which are not available in most medical centers, breath tests have

been developed as a more available and practical approach to determine SIBO. Patients drink solutions with glucose or lactulose and provide breath samples that are collected over the next 2-3 hours and analyzed for hydrogen and methane concentrations.<sup>3</sup> The sensitivity of these tests has been called into question and different guidelines have been proposed to define a positive breath test.

The lactulose breath test (LBT) is defined as a positive test in the literature in different ways. The initial focus in LBT was in 2 peaks and no specific time frame recommended for the first peak, specifically that a test was regarded as positive if the hydrogen exceeded 20 ppm at least 15 minutes before the colonic peak occurred. A range of 45–120 minutes was noted as the time of the initial hydrogen peak in controls signaling cecal arrival.<sup>4</sup> The first peak is thought to result from encountering bacteria in the small intestine. A second peak occurs later when lactulose reaches the colon. More recently, a review article suggested a first hydrogen peak before 90 minutes as a positive test.<sup>5</sup> Therefore, based on the literature available we decided a positive test was defined as whether the hydrogen concentration exceeded 20 ppm by 100 minutes. This was based on “middle ground” from the different opinions that were published.<sup>2,4,5</sup>

Previously conducted simultaneous hydrogen breath testing (HBT) and scintigraphic studies of isotope-labeled lactulose to investigate small-bowel transit concluded that the mean cecal arrival time was 73 minutes and individual arrival times ranged from 30–139 minutes. A total of 69% of patients had arrival times that were less than 90 minutes by both HBT and scintigraphy. The median arrival time by scintigraphy was 64 minutes and by HBT was 74 minutes.<sup>6</sup> In another report, patients with irritable bowel syndrome also received isotope-labeled lactulose and their cecal arrival times ranged from 10–220 minutes and the mean was 71 minutes.<sup>7</sup>

Breath testing provides a more readily available, safe, inexpensive and noninvasive alternative to jejunal aspiration and culture for the diagnosis of SIBO. A rationale for LBT is that it could detect cases of distal small-bowel (ileal) bacterial overgrowth and pathologic bacterial strains not identified by culturing techniques of the more proximal small bowel (jejunum).<sup>8</sup>

Breath testing is unable to distinguish metabolism of lactulose from small-bowel or colonic flora as it is not absorbed in the small bowel and is therefore a non-absorbed sugar when it arrives in the colon. Another consideration is that lactulose actually accelerates small-bowel intestinal transit<sup>9</sup> and this would further impair the diagnostic accuracy of breath testing. There is also evidence that low-dose lactulose actually induces increased contractions of the colon smooth muscle and therefore increases cecal and colonic motility; all factors which can conceivably confound interpretation of changes in hydrogen concentration during the LBT.<sup>10</sup>

## METHODS

### Subjects

This was a retrospective study analyzing the breath test findings of 153 patients who were referred for LBT testing at a single academic tertiary referral center from 2011-2013 for suspected SIBO based on such symptoms as gas, bloating, abdominal distension, diarrhea, constipation, abdominal pain, nausea and vomiting.

### Measurements

#### Lactulose Hydrogen Breath Testing

LBT was performed using a Quintron BreathTracker SC Digital Microlyzer with carbon dioxide calibration. Patients ingested 10 g of lactulose in 120 cc of water after 2 baseline breath samples were collected followed by breath samples obtained every 20 minutes for 180 minutes. Test results were analyzed based on 2 guidelines. (1) *The literature guidelines*: a hydrogen concentration of greater than 20 ppm from a baseline less than 10 ppm achieved within a 100 minutes after ingestion of 10 g of lactulose in 100 cc of water, followed by a further rise of greater than 15 ppm within 180 minutes was interpreted as a positive test for SIBO. (2) *Our new proposed criteria for a positive result*: a hydrogen concentration of greater than 20 ppm from a

baseline less than 10 ppm by either 60 or 80 minutes after ingestion of 10 g lactulose followed by a further rise of greater than 15 ppm during the 180 minutes of sampling. All patients who had a baseline hydrogen or methane greater than or equal to 10 ppm at baseline were excluded. All breath tests were evaluated by a single, experienced reader (RWM).

Patients adhered to the following instructions for the breath test. On the day before the test, their diet was limited to baked or broiled chicken, white bread, plain steamed white rice, eggs and clear chicken or beef broth with no vegetables. The patients had to fast for 12 hours before the test. For 1 hour before and during the test, patients could not fall asleep, perform vigorous exercise or smoke. Patients were to wait more than 14 days after having received colonoscopy, barium studies or antibiotic therapy. Patients remained fasting throughout the 3 hours study. For breath hydrogen samples greater than 10 ppm at baseline, patients were asked to brush their teeth and take mouthwash to gargle to see if hydrogen concentrations fell to less than 10 ppm. If so, breath sampling continued for 3 hours. If breath H<sub>2</sub> and CH<sub>4</sub> remained > 10 ppm, then this data were not included in our analysis.

### Statistical Analysis

The 2 methods of diagnosis were compared using McNemar's test. The performance of a new procedure in relation with the existing 1 was assessed using positive proportion (PPA) and negative proportion (NPA) agreements. The estimate of PPA and NPA and their 95% CI were reported.  $P < 5\%$  was considered significant. Statistical analysis was carried out using STAT 12.1. Overall, raw agreement between procedures was estimated as 92%.

## RESULTS

A total of 153 LBTs were analyzed from a University Motility Center from 2011-2013 for the indication of suspected SIBO based on symptoms such as gas, bloating, abdominal distension, diarrhea, constipation, abdominal pain, nausea and vomiting. Mean age was 54.6 years (range: 23-86) and 84.3% were women. Using the Current Guidelines, the 153 LBT results were scrutinized. Overall, 40 (26.1%) patients tested positive by 100 minutes (Table 1). Based on the proposed criteria, 18 (11.8%) patients tested positive by 60 minutes and 28 (18.3%) patients tested positive by 80 minutes (Table 1).

**TABLE 1.** Cumulative data of positive lactulose breath test results identified at time intervals over the 180 minutes duration of the breath sampling.

Time (minutes)	Percentage of patients with hydrogen concentration > 20 ppm (%)
60	11.8
80	18.3
100	26.1

Download English Version:

<https://daneshyari.com/en/article/2863245>

Download Persian Version:

<https://daneshyari.com/article/2863245>

[Daneshyari.com](https://daneshyari.com)