BREATH HYDROGEN AND METHANE TESTING FOR SIBO (the lactulose breath hydrogen test)

Introduction

Biolab follows protocols for breath hydrogen and methane testing that are in line with current practice in Europe and America [1,2].

Normally the human small intestine is sparsely colonised by bacteria in comparison to the colon. Structural or functional disorders of the gastrointestinal tract can lead to bacterial overgrowth in the small intestine, with colonic bacteria proliferating in the ileum and jejunum. Small intestinal bacterial overgrowth (SIBO), as it is known, is characterized by steatorrhea and diarrhoea, together with vitamin deficiencies and carbohydrate malabsorption as the overgrowth causes damage to the absorptive surface of the intestine. The syndrome is difficult to diagnose with accuracy using blood tests.

Bacteria growing in the intestine can break down carbohydrates to produce hydrogen and methane, which are rapidly transported to the lungs via the portal blood supply and the liver. The sole source of these gases in alveolar air is bacterial fermentation of carbohydrate in the gut, so estimation of hydrogen and methane in breath samples can be used to study the passage of carbohydrates through the gut and the presence of pathogenic bacteria in the gastro-intestinal lumen.

Breath tests can be helpful in the evaluation of bloating, diarrhoea, constipation and malabsorption. These tests are safe alternatives to more invasive procedures such as biopsy. However, it is important to evaluate both hydrogen and methane production if false negative results are to be avoided. According to research from the 1970's, which was then repeated in 2006 [3], approximately 35% of healthy adult subjects are methane producers. It was also reported that, in 34% of lactose intolerant patients with a negative hydrogen breath test, the methane percentage increase after a lactose challenge was greater than 100%. In the same study, out of 13 subjects with a false negative breath hydrogen response to lactulose, 11 subjects had a methane percentage increase greater than 100% [4]. Methanogenic bacteria are independent of hydrogen-producing bacteria; so methane determination along with the measurement of hydrogen is required in carbohydrate breath tests [5].

SIBO and IBS

Breath testing to aid in the diagnosis of small intestinal bacterial overgrowth (SIBO) may also provide a framework for the understanding of irritable bowel syndrome (IBS) [6,7]. Recent work has demonstrated that among IBS subjects, methane production in the lactulose breath test is associated with constipation. Methane also appears to slow down the passage of food through the intestinal tract [8]. There is an increasing interest in the overlap between SIBO and IBS [9,10]. Causes of IBS are still unknown, but it has been hypothesized that there is a dysregulation of intestinal function and a strong association with emotional factors and stress [11] Specific intestinal microbial overgrowth has also been reported to contribute to the onset of IBS [12,13,14]. A recent report suggests that SIBO is found in 78% to 84% of patients with the common symptoms of IBS [15].

With regard to the symptoms of SIBO and IBS, it has been proposed that, in SIBO patients, there is abnormal production of gases in the small intestine, which could explain their bloating and abdominal pain

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[16]. Sugar malabsorption, causing increased carbohydrate fermentation, organic acid production and consequent reduction in bowel pH, may play a role in symptoms such as diarrhoea [10]. A known complication of SIBO is also the translocation of bacteria from the lumen of the gut across the mucosal barrier and into the mesenteric lymph nodes and visceral organs [17]. A consequence of this bacterial translocation is the activation of the immune response in the adjacent organs, which might explain both the abnormal motility and visceral hypersensitivity found in IBS patients [18,19]. It could also be related to the other immune-mediated disorders, such as fibromyalgia, interstitial cystitis, and chronic fatigue which are associated with this condition [20,21].

Indications

The lactulose breath test is used for the diagnosis of small intestinal bacterial overgrowth (SIBO) and the study of intestinal transit time. Different breath testing protocols are used to investigate lactose and fructose malabsorption.

Patient preparation

No food and no alcohol should be consumed for 12 hours prior to the test, with only water to drink. Slowly digesting foods such as beans should be avoided on the day before the test. Recent antibiotic therapy may interfere with the results.

Specimen requirements: Alveolar breath samples. Home sampling test kits available.

Test Protocol

For the lactulose breath test the patient consumes 10 gm of lactulose syrup with 200 ml of water; alveolar air samples are collected at baseline and then every 20 minutes for 3 hours (a total of 10 samples). If the result is equivocal, it is recommended that the test should be repeated using 40 gm of lactulose.

Interpretation

Normally there is a peak in hydrogen production two hours after lactulose ingestion, reflecting the passage of this non-absorbable carbohydrate into the colon. With increased intestinal transit time, for example where there is significant methane production, the appearance of this hydrogen peak may be somewhat delayed. In small intestinal bacterial overgrowth (SIBO) there is a bi-phasic response - an earlier peak of hydrogen production, before 90 minutes post lactulose, which reflects the breakdown of lactulose in the jejunum and ileum. A lactulose breath test for SIBO is thus *positive* if there is a biphasic pattern of breath hydrogen or methane production. Two peaks of gas production are observed in a *positive* test:

a) an early increase of at least 20 ppm for the sum of the concentration of the two gases,
b) a larger increase (greater than 20 ppm) corresponding to the appearance of lactulose in the colon.

In cases of fast intestinal transit time the two peaks may merge as an early plateau of gas production.

In a *negative* lactulose test only the colonic peak in gas production is observed and there is no significant increment in gas production prior to 120 minutes post lactulose ingestion. The absence of normal colonic bacterial fermentation suggests that the patient has recently used antibiotics.

The lactulose breath test can also detect impaired intestinal transit time; transit time is *normal* if the physiological peak of colonic hydrogen and methane production (≥20 ppm) is detected at 80 minutes, *slow* if the peak is detected at 100 minutes or later, or *fast* if the peak is detected at 60 minutes or earlier. The presence of lactulose increases intestinal motility, so these transit times are not typical of a normal meal.

Antibiotics continue to distort the test result of the hydrogen breath test to up to four weeks after they have been discontinued [22]. It is recommended not to carry out the test if the patient has been on recent antibiotic therapy. Equally, the taking of laxatives, in particular of lactulose (*Laevolac*R) should be

discontinued at least three days prior to the test. After a colonoscopy the intestinal flora needs up to four weeks to recover. The same applies after the execution of other intestinal examinations where prior 'bowel cleaning' has been carried out, such as, for example, after an irrigoscopy or a Sellink procedure [23].

Methodology

Breath hydrogen and methane are measured in alveolar breath samples by gas-liquid chromatography.

Turn around time: Typically 5 working days.

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