



Small Intestinal Bacterial Overgrowth: Updates and Clinical Implications

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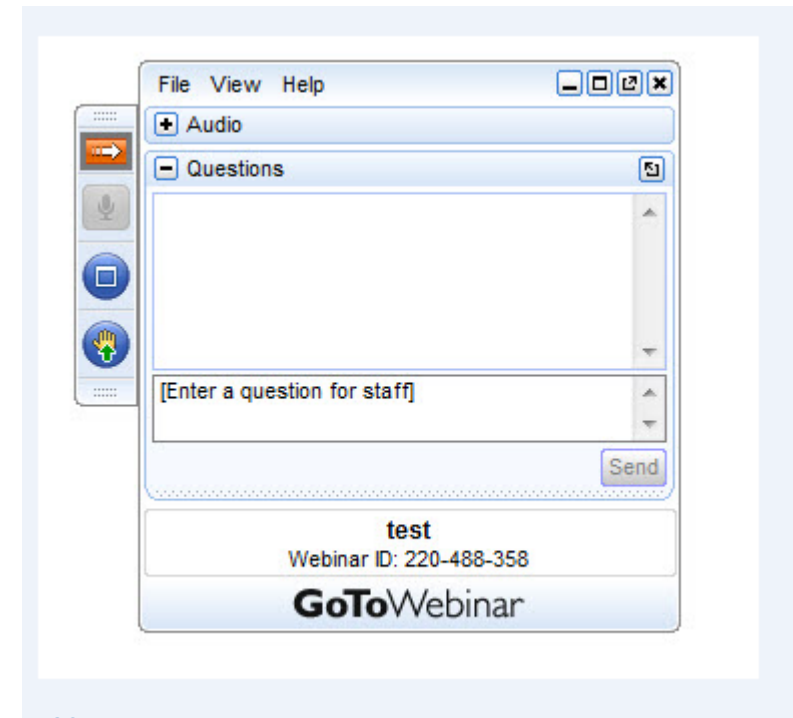


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Technical Issues & Clinical Questions

- Please type any technical issue or clinical question into either the “Chat” or “Questions” boxes, making sure to send them to “Organizer” at any time during the webinar.
- We will be compiling your clinical questions and answering as many as we can the final 15 minutes of the webinar.



DISCLAIMER: Please note that any and all emails provided may be used for follow up correspondence and/or for further communication.



Need More Resources?

Ensure you have an account!

The screenshot shows the Genova Diagnostics website homepage. At the top, there is a navigation bar with social media icons (Twitter, LinkedIn, YouTube, Facebook) and links for International, About Us, Contact Us, Search, myGDX, and US. The main header features the Genova Diagnostics logo and navigation links for HOME, CLINICIANS, and PATIENTS. Below the header is a banner for "NutrEval® with Genomics" with the tagline "The Nutritional Test You Rely On Just Got Better!" and a "LEARN MORE" button. The main content area is divided into three columns, each with a red circle around it:

- Getting Started:** Simple account setup. Licensed healthcare practitioners may begin the process of opening a free account here. Includes a "NEW USERS" button.
- Test Menu:** A comprehensive menu of our diagnostic tests, including test descriptions, specimen requirements and kit instructions. Includes a "SEARCH TESTS" button.
- myGDX Login:** Clinicians: Log in to the myGDX™ portal to order test kits and materials, download patient results, edit account information. Includes a "LOGIN" button.

At the bottom, there is a section for "Online Education" with a red circle around it. It includes the text: "Visit our Medical Education section for access to LIVE GDX Webinars, Educational Modules, Conferences, and LEARN GDX – short learning modules that demonstrate the clinical utility and diagnostic significance of key biomarkers. The modules are absolutely free to view!" and a "LEARN NOW" button.



Small Intestinal Bacterial Overgrowth: Updates and Clinical Implications

Christine Stubbe, ND



Learning Objectives

- Overview of SIBO
- Learn when to consider testing for SIBO
- Review the test in detail
- Discuss treatment recommendations
- Case examples
- GI and other test considerations



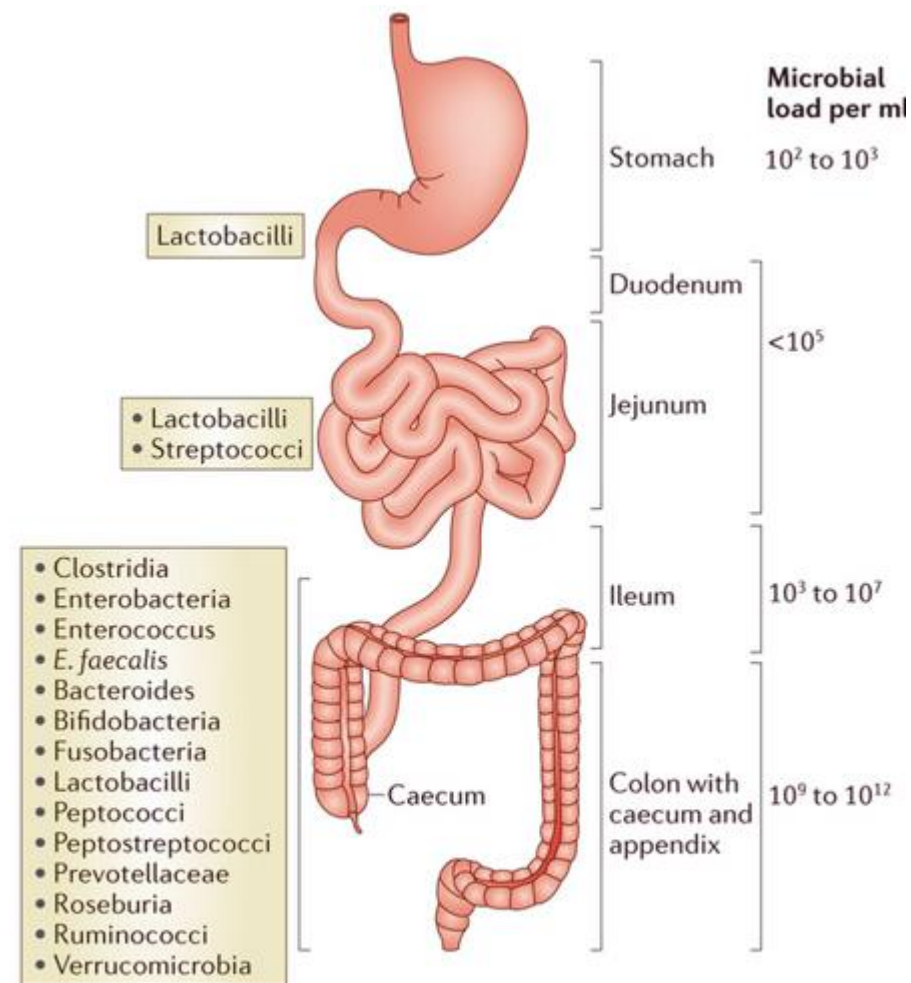


What is Small Intestinal Bacterial Overgrowth?

- “Small Intestinal Bacterial Overgrowth is a heterogeneous syndrome characterized by an increased number and/or abnormal type of bacteria in the small bowel.”
- “SIBO is a condition in which the small bowel is colonized by excessive numbers of aerobic and anaerobic microbes that are normally found in the large intestine.”
- “Currently a bacterial concentration of $>10^3$ c.f.u./ml is generally considered significant.”



Bacterial Concentrations Throughout the GI Tract



Nature Reviews | Immunology



Ways the Body Innately Prevents the Overgrowth of Bacteria in the Small Intestine

- Gastric acid
- Pancreatic and biliary secretions
- Peristalsis and the migrating motor complex (MMC) – stasis promotes bacterial growth
- Ileocecal valve – prevents reflux of colonic bacteria into the small intestine

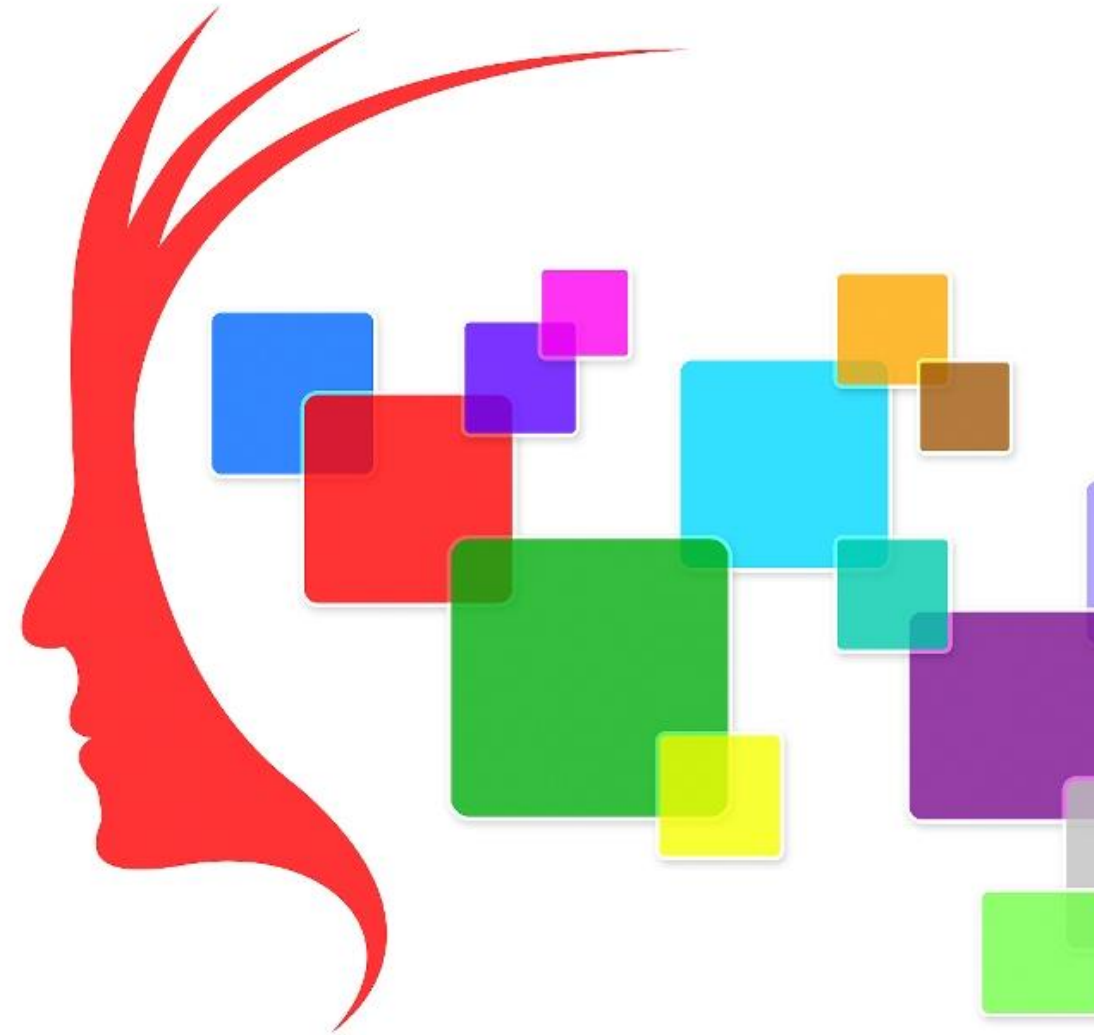
The compromise of any of these processes can lead to the development of SIBO



When to Consider SIBO?

Signs and Symptoms

Associated Conditions and Risk Factors





What are the Common Signs and Symptoms of SIBO?

- Abdominal bloating
- Excessive gas or belching
- Abdominal cramps
- Diarrhea
- Constipation
- Nausea
- Heartburn
- Steatorrhea
- Nutrient deficiencies
 - Vitamin B12
 - Iron
 - Macronutrient malabsorption
 - Fat-soluble vitamins
 - RBC folate



Conditions with a High Prevalence of Overgrowth

- Functional GI and motility disorders (such as IBS & gastroparesis)
- Neuromuscular Diseases (such as restless leg syndrome)
- Inflammatory Bowel Disease (IBD)
- Pancreatic disease
- Celiac disease
- Hypothyroidism
- Liver disease
- Diabetes
- Fibromyalgia
- Rosacea
- Parkinson's disease
- Obesity
- Plus many other conditions



Prevalence of SIBO in Common Conditions

- IBS
 - 78% of patients positive
 - 48% of patients treated successfully for SIBO no longer met Rome criteria
- Fibromyalgia and Chronic Fatigue Syndrome
 - 42/42 patients with fibromyalgia had an abnormal lactulose breath test with significantly greater hydrogen production; significant correlation between degree of pain and peak hydrogen level
 - 77% of CFS patients were found to have SIBO
- Hypothyroidism
 - 54% of patients with hypothyroidism have SIBO compared with 5% of controls
 - “Hypo- and hyperthyroidism, often of autoimmune origin, are respectively associated to small intestinal bacterial overgrowth and to changes in microbiota composition.”

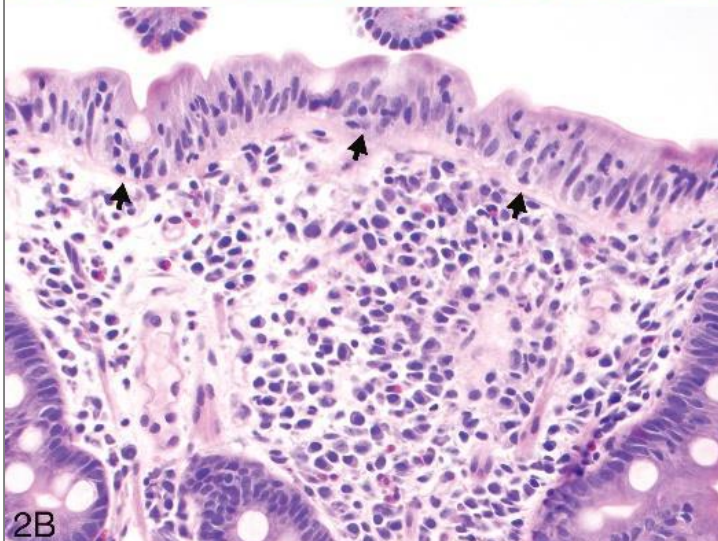
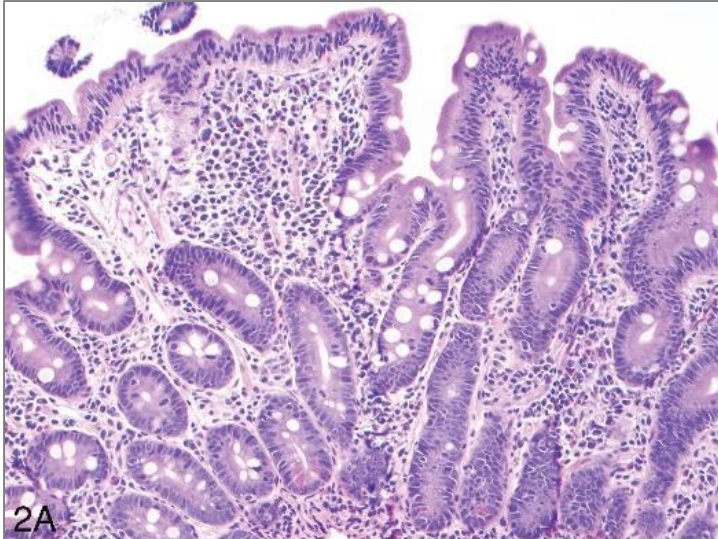


What are Risk Factors for the Development of SIBO ?

- Mechanical Stasis
 - Structural/Anatomic: Small intestine diverticula, strictures, surgery
 - Motility Disorders: Gastroparesis, Medications (i.e. opioid analgesics)
- Irritable Bowel Syndrome
- Hypothyroidism
- Metabolic Disorders: Diabetes
- Elderly Age
- Organ System Dysfunction: Liver, kidney, pancreatic dysfunction, Crohn's, Celiac
- Immunodeficiency states
- Hypochlorhydria
- Medications: Recurrent antibiotics and gastric acid suppressors
- GI Infection



SIBO Can Cause Histopathologic Change of Small Intestine



- An overgrowth of bacteria in the small intestine can cause:
 - Blunting of the villi
 - Thinning of the mucosa and crypts
 - Increased intraepithelial lymphocytes
 - Microscopic inflammatory changes



Testing for SIBO

Gold Standard: Aspirate and Culture
Breath Testing





Gold Standard

Aspirate of small bowel fluid followed by culture and bacterial count

Disadvantages

- Invasive procedure as the small intestine must be intubated so that aspirates can be collected
- Culture-based techniques do not allow for growth of all organisms, thus may underestimate the bacterial population
- Potential for contamination of instrumentation and inaccurate sampling due to technical problems
- Endoscopy can only reach the upper portion of the small intestine and colonoscopy can only reach the lower, thus the substantial middle section of the small intestine is not accessible by this method



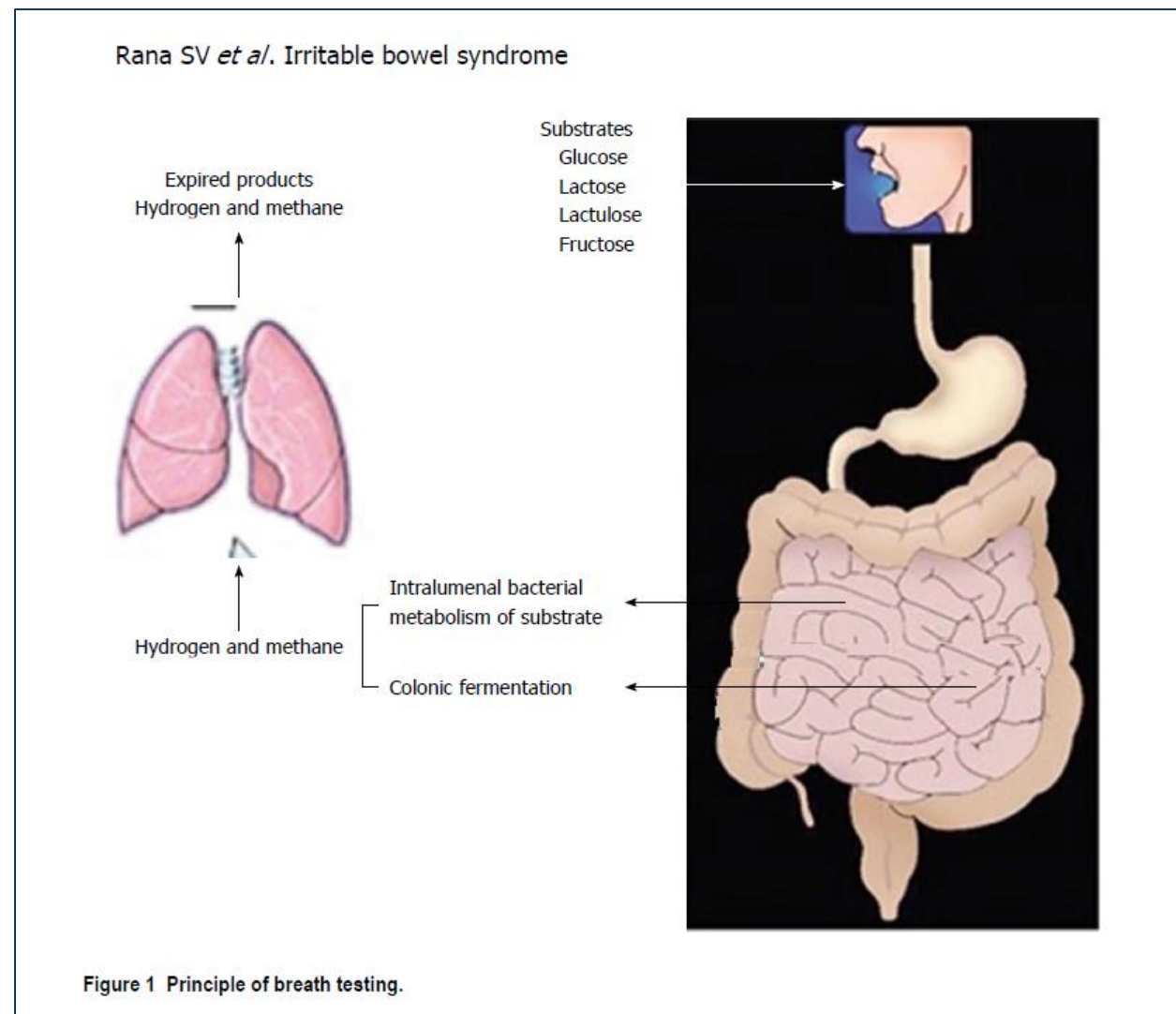
Breath Testing versus Small Bowel Aspiration

- “Unlike breath testing, small bowel aspiration is invasive, time-consuming and costly.”
- “Breath Testing is a useful, inexpensive, simple and safe diagnostic test in the evaluation of common gastroenterology problems.”



Breath Testing for SIBO

- Baseline breath measurement
- Drink substrate (lactulose)
- Lactulose transits through small intestine - if bacteria are present, H₂ (hydrogen) or CH₄ (methane) gas is produced
- H₂ and CH₄ absorbed through intestines into bloodstream
- Gases carried to lungs through bloodstream and expired
- Breath collected at timed points





Testing Substances for SIBO Breath Test

Lactulose

- Cannot be digested or absorbed by humans, thus passes through entire length of small intestine
- **Advantage:** Can diagnose distal overgrowth which is thought to be more common
- Not as sensitive as glucose

Glucose

- Glucose is absorbed within first few feet of small intestine, thus can only diagnose proximal overgrowth
- **Disadvantage:** Cannot diagnose distal overgrowth
- Accurate diagnosis of proximal overgrowth



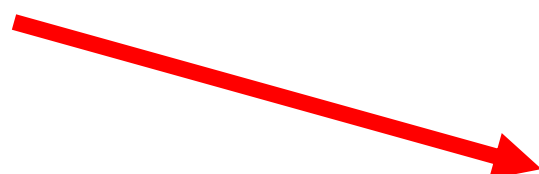
Collection Pack Instructions

- Very important to review the instructions with the patient as they are detailed and specific
- Improper collection can lead to ambiguous results
- Key instructions:
 - 4 weeks prior: No antibiotics, colonoscopy or barium enema
 - 7 days prior: No laxatives, stool softeners, stool bulking agents or antacids
 - 24 hours prior: Diet limited to a few foods and no probiotics
 - 12 hours prior (fasting with only water): No non-essential medications/supplements, toothpaste, gum, candies or mouthwash
 - 1 hour prior and during testing (fasting with only water): No smoking, sleeping, vigorous exercise or toothpaste



Collection Pack Instructions Continued...

- Collection technique with timing and breathing into the tube may need to be reviewed with the patient
 - Breathe normally, inhale and hold 5 seconds
 - Exhale normally into mouthpiece (do not blow hard)
 - Insert tube and remove after 2 seconds
 - Record times on labels and requisition form



Great demonstration video for patients to watch can be found on the SIBO page on www.gdx.net:

www.gdx.net/product/bacterial-overgrowth-of-the-small-intestine-sibo-test

___ **Small Intestinal Bacterial Overgrowth (SIBO)-2 Hour** *Check here for full profile*

Profile Components/CPT Codes
___Hydrogen Breath Test 91065

___ **Small Intestinal Bacterial Overgrowth (SIBO)-3 Hour** *Check here for full profile*

Profile Components/CPT Codes
___Hydrogen Breath Test 91065

Please Record Your Collection Times in the Blank Fields

Specimen Intervals	RECORD COLLECTION TIMES hours/min	circle one	Example
SAMPLE 1 @ 0 min		AM or PM	8:00 AM
SAMPLE 2 @ 20 min		AM or PM	8:20 AM
SAMPLE 3 @ 40 min		AM or PM	8:40 AM
SAMPLE 4 @ 60 min		AM or PM	9:00 AM
SAMPLE 5 @ 90 min		AM or PM	9:30 AM
SAMPLE 6 @ 120 min		AM or PM	10:00 AM
ONLY COLLECT/RECORD TIMES BELOW IF USING THE SIBO 3 HOUR TEST			
SAMPLE 7 @150 min		AM or PM	10:30 AM
SAMPLE 8 @ 180 min		AM or PM	11:00 AM



Test Interpretation





2017 North American Breath Testing Consensus Guidelines

- Standardization was lacking regarding indications for testing, test methodology and interpretation of results
- Who formed the consensus group?
- Consensus was reached on 26 statements in the areas of indications, preparation, performance, interpretation of results and knowledge gaps

Open

Hydrogen and Methane-Based Breath Testing in Gastrointestinal Disorders: The North American Consensus

Ali Rezaie, MD, MSc, FRCP(C)¹, Michelle Buresi, MD², Anthony Lembo, MD³, Henry Lin, MD⁴, Richard McCallum, MD⁵, Satish Rao, MD⁶, Max Schmulson, MD⁷, Miguel Valdovinos, MD⁸, Salam Zakko, MD⁹, Mark Pimentel, MD, FRCP(C)¹ and on behalf of The North American Consensus group on hydrogen and methane-based breath testing

- OBJECTIVES:** Breath tests (BTs) are important for the diagnosis of carbohydrate maldigestion syndromes and small intestinal bacterial overgrowth (SIBO). However, standardization is lacking regarding indications for testing, test methodology and interpretation of results. A consensus meeting of experts was convened to develop guidelines for clinicians and research.
- METHODS:** Pre-meeting survey questions encompassing five domains; indications, preparation, performance, interpretation of results, and knowledge gaps, were sent to 17 clinician-scientists, and 10 attended a live meeting. Using an evidence-based approach, 28 statements were finalized and voted on anonymously by a working group of specialists.
- RESULTS:** Consensus was reached on 26 statements encompassing all five domains. Consensus doses for lactulose, glucose, fructose and lactose BT were 10, 75, 25 and 25g, respectively. Glucose and lactulose BTs remain the least invasive alternatives to diagnose SIBO. BT is useful in the diagnosis of carbohydrate maldigestion, methane-associated constipation, and evaluation of bloating/gas but not in the assessment of oro-cecal transit. A rise in hydrogen of ≥ 20 p.p.m. by 90 min during glucose or lactulose BT for SIBO was considered positive. Methane levels ≥ 10 p.p.m. was considered methane-positive. SIBO should be excluded prior to BT for carbohydrate malabsorption to avoid false positives. A rise in hydrogen of ≥ 20 p.p.m. from baseline during BT was considered positive for maldigestion.
- CONCLUSIONS:** BT is a useful, inexpensive, simple and safe diagnostic test in the evaluation of common gastroenterology problems. These consensus statements should help to standardize the indications, preparation, performance and interpretation of BT in clinical practice and research.

SUPPLEMENTARY MATERIAL is linked to the online version of the paper at <http://www.nature.com/ajg>

Am J Gastroenterol 2017; 112:775–784; doi:10.1038/ajg.2017.46; published online 21 March 2017

INTRODUCTION

Breath test (BT) is performed to aid in the diagnosis of many common gastroenterological conditions including small intestinal bacterial overgrowth (SIBO) and irritable bowel syndrome

(IBS)-like symptoms, carbohydrate maldigestion and dysfunction or alterations in oro-cecal transit. Presently in clinical practice, BT is being performed with various substrates (e.g., glucose, lactulose, fructose, sorbitol, sucrose and inulin) using variable doses for a range

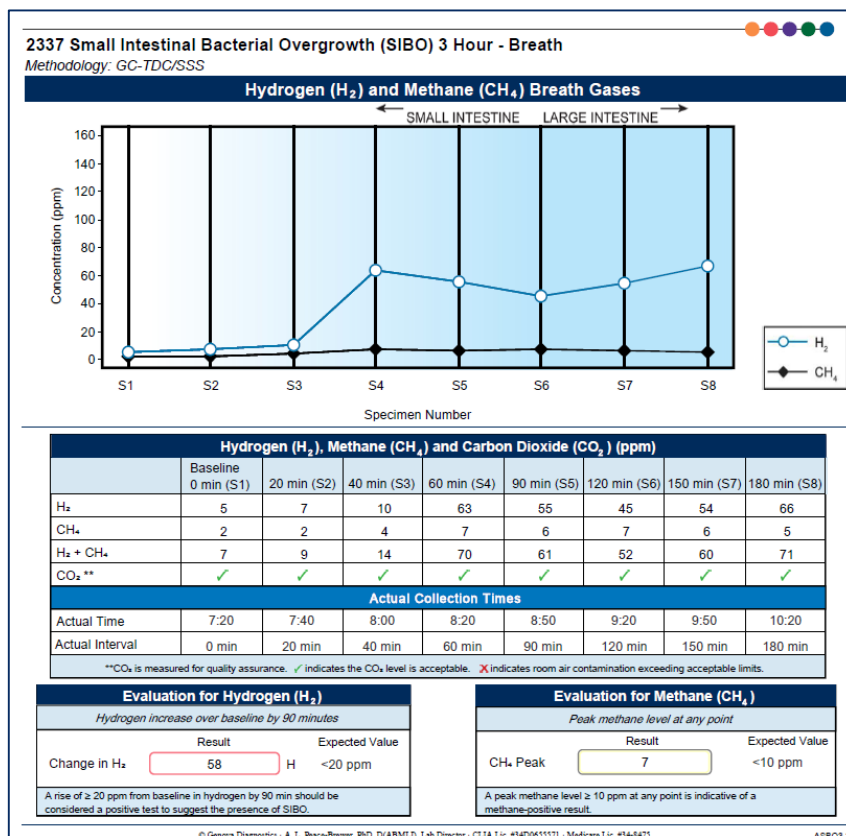
¹GI Motility Program, Division of Gastroenterology, Department of Medicine, Cedars-Sinai, Los Angeles, California, USA; ²Division of Gastroenterology, Department of Medicine, University of Calgary, Calgary, Alberta, Canada; ³Beth Israel Deaconess Medical Center, Department of Medicine, Boston, Massachusetts, USA; ⁴New Mexico VA Health Care System, Division of Gastroenterology and Hepatology, Department of Medicine, University of New Mexico School of Medicine, Albuquerque, New Mexico, USA; ⁵Department of Internal Medicine, Texas Tech University Health Sciences Center El Paso, El Paso, Texas, USA; ⁶Division of Gastroenterology and Hepatology, Department of Medicine, Augusta University, Augusta, Georgia, USA; ⁷Laboratorio de Hígado, Páncreas y Motilidad (HIPAM)-Unit of Research in Experimental Medicine, Faculty of Medicine-Universidad Nacional Autónoma de México (UNAM), Department of Medicine, Mexico City, Mexico; ⁸GI Motility and Neurogastroenterology Unit, Department of Gastroenterology, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubiran, Mexico City, Mexico; ⁹Connecticut Gastroenterology Institute, Department of Medicine, Bristol Hospital, Bristol, Connecticut, USA. **Correspondence:** Ali Rezaie, MD, MSc, FRCP(C), Assistant Professor, Assistant Director, GI Motility Program, Cedars-Sinai Medical Center, 8730 Alden Drive, Suite 2E, Los Angeles, California 90048, USA. E-mail: ali.rezaie@cshs.org

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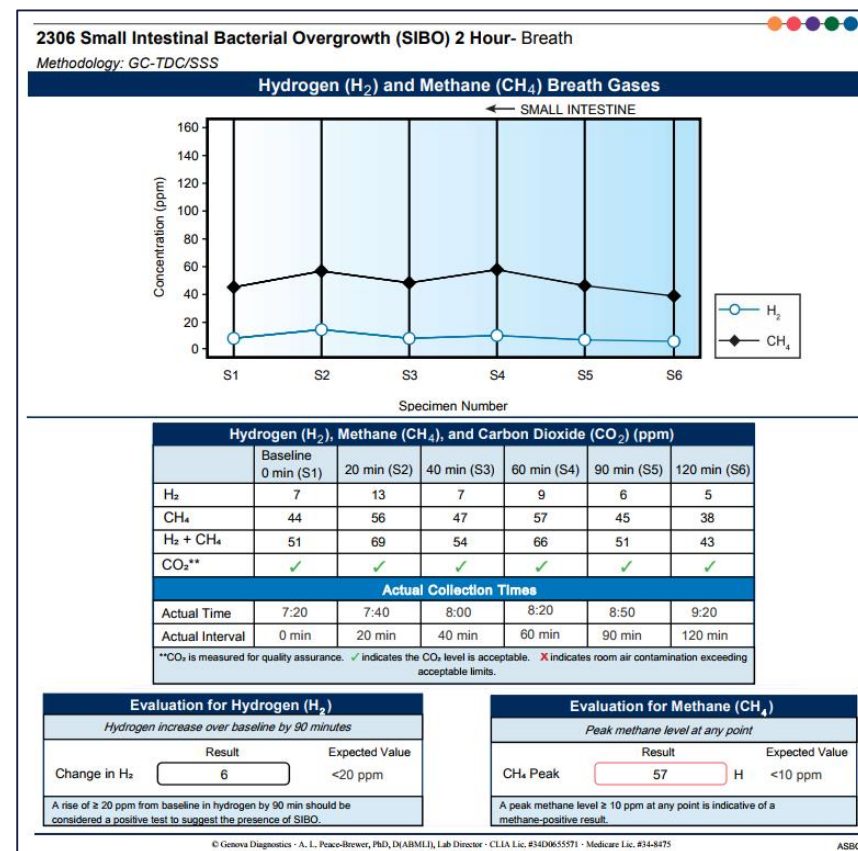


Breath Tests: 3-Hour versus 2-Hour

3-Hour SIBO Breath Test



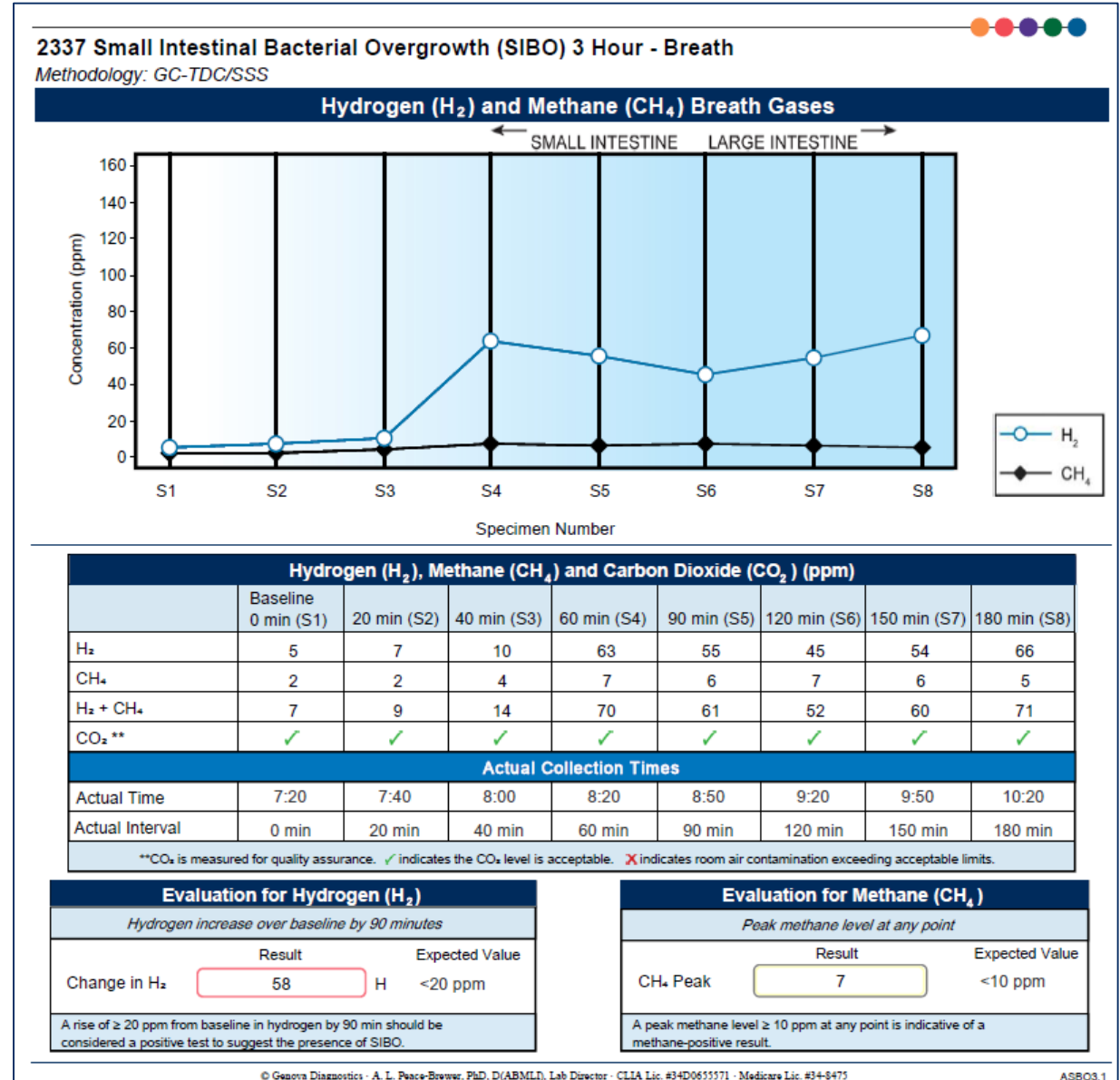
2-Hour SIBO Breath Test





Test Components

- Graph of hydrogen (H₂) and methane (CH₄)
- Chart of breath gases at the timed points
- Carbon dioxide (CO₂) evaluation for quality control
- Actual collection times
- Evaluation for hydrogen
- Evaluation for methane





Evaluation for Hydrogen (H₂)

- A rise of H₂ of >20 ppm over baseline in the first 90 minutes of testing is positive for SIBO
- Genova's Evaluation for hydrogen based on consensus paper; this cut point is seen widely throughout the literature

Evaluation for Hydrogen (H ₂)		
Hydrogen increase over baseline by 90 minutes		
	Result	Expected Value
Change in H ₂	2	< 20 ppm
A rise of \geq 20 ppm from baseline in hydrogen by 90 min should be considered a positive test to suggest the presence of SIBO.		



Evaluation for Hydrogen

- Significance of elevated baseline H₂ levels in patients reporting adherence to fasting and dietary guidelines is not known
 - In a symptomatic patient, some clinical groups with expertise in SIBO management may consider an elevated hydrogen baseline a positive test
- Approximately 8 to 27% of individuals do not produce H₂ due to the presence of methanogenic microbiota which consume hydrogen molecules to produce methane gas
 - Low H₂ findings through all time points in a symptomatic patient may reflect a false negative result
 - Clinical attention should be shifted to evaluation of CH₄



Evaluation for Methane (CH₄)

- The consensus group and other papers refer to an absolute value of 10 or greater at any point during the test as a “methane positive” result
 - Results 10+ will be outlined in red and flagged with an “H”
- Peer-reviewed literature suggests an association with certain clinical conditions and methanogen overgrowth at levels as low as 3 ppm, CH₄ values between 3 and 9 may indicate the need for clinical intervention in the symptomatic patient
 - Results 3-9 will be outlined in yellow
- Emerging literature suggests that unlike H₂, an elevated CH₄ level at baseline is common

Evaluation for Methane (CH ₄)		
<i>Peak methane level at any point</i>		
	Result	Expected Value
CH ₄ Peak	5	< 10 ppm

A peak methane level \geq 10 ppm at any point is indicative of a methane positive result.



Evaluation for Methane

- Utilization of breath methane levels for SIBO assessment is controversial largely due to a lack of validation related to diagnostic specifics such as timing and magnitude of increase
 - The rise of CH₄ during breath testing appears to not be as sharp as H₂
- However, CH₄ measurements are increasingly obtained to address other clinical questions such as:
 - Constipation
 - Methane gas itself may slow intestinal transit, and patients with CH₄-predominant bacterial overgrowth have been found to be five times more likely to have constipation compared to individuals with H₂-predominant overgrowth
 - The severity of constipation has been found to directly correlate with the CH₄ level
 - Irritable Bowel Syndrome (IBS)
 - Obesity



Carbon Dioxide (CO₂)

Hydrogen (H ₂), Methane (CH ₄) and Carbon Dioxide (CO ₂) (ppm)								
	Baseline 0 min	20 min	40 min	60 min	90 min	120 min	150 min	180 min
H ₂	8	11	10	8	10	25	NR	50
CH ₄	4	4	3	4	2	5	NR	4
H ₂ + CH ₄	12	15	13	12	12	30	NR	54
CO ₂ *	✓	✓	✓	✓	✓	✓	X	✓
Actual Collection Times								
Actual Time	8:10	8:38	8:55	9:10	9:55	10:15	10:42	11:17
Actual Interval	0 min	28 min	45 min	60 min	105 min	120 min	147 min	187 min
*CO ₂ is measured for quality assurance. ✓ indicates the CO ₂ level is acceptable. X indicates room air contamination exceeding acceptable limits.								

Carbon Dioxide (CO₂) is measured in every sample. CO₂ levels exceeding acceptable limits indicate room air contamination likely at the time of sample collection. If CO₂ levels exceed acceptable limits, sample integrity is questionable and results are designated as non-reportable (NR).



Actual Collection Times

Actual Collection Times								
Actual Time	8:10	8:38	8:55	9:10	9:55	10:15	10:42	11:17
Actual Interval	0 min	28 min	45 min	60 min	105 min	120 min	147 min	187 min

On the report



On the requisition form



Small Intestinal Bacterial Overgrowth (SIBO)-2 Hour *Check here for full profile*

Profile Components/CPT Codes
___Hydrogen Breath Test 91065

Small Intestinal Bacterial Overgrowth (SIBO)-3 Hour *Check here for full profile*

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ONLY COLLECT/RECORD TIMES BELOW IF USING THE SIBO 3 HOUR TEST			
SAMPLE 7 @150 min		AM or PM	10:30 AM
SAMPLE 8 @ 180 min		AM or PM	11:00 AM



Actual Collection Times

Actual Time

- The actual time of collection of samples is provided to enhance clinical interpretation
- The actual times reported are utilized to determine the actual interval for comparison to the recommended interval

Actual Interval

- The actual interval can be compared to the recommended collection interval. If the recommended collection interval is not followed correctly, interpretation should be made within the context of the altered collection schedule. Generally, deviations of a few minutes will not significantly alter the interpretation.
- If the 90-minute interval is missed, evaluation for hydrogen may be affected, since the criteria for diagnosis of hydrogen-producing bacterial overgrowth is by 90-minutes



Treating SIBO

Treat the overgrowth

Provide nutritional support

Correct the underlying cause





Treating SIBO

- For the majority of patients diagnosed with a positive breath test, SIBO will likely be a chronic and relapsing condition
 - For example, one study found that 44% of patients treated successfully with antibiotics relapse within 9 months
- Goals of treatment are threefold:
 - Treat the overgrowth
 - Provide nutritional support
 - Correct the underlying cause



Treating SIBO – Treat the Overgrowth

- Rifaximin
- Rifaximin plus Neomycin (or Metronidazole)
- Botanicals
 - Berberine
 - Allicin (component of garlic)
 - Oregano oil
 - Neem
 - Others



Treating SIBO – Provide Nutritional Support

- **Nutritional consequences include:**
 - Weight loss
 - Fat soluble vitamin deficiency
 - Vitamin B12 deficiency
 - Iron deficiency
 - Low serum bile acids
 - Low RBC folate levels
- **Common diets prescribed for SIBO**
 - Specific Carbohydrate Diet (SCD)
 - Low FODMAPs
 - Elemental Diet



Treating SIBO – Address the Cause

- The migrating motor complex (MMC) describes the waves of electromechanical activity that sweep through the intestines in a regular cycle
- The MMC is responsible for moving bacteria from the small intestine to the large intestine, as well as for inhibiting migration of colonic bacteria into the terminal ileum
- Supporting optimal function of the MMC includes:
 - Meal spacing every 4-5 hours with overnight 12 hour fast
 - Use of prokinetic agents
 - Pharmaceutical agents such as low-dose erythromycin, Tegaserod, low-dose naltrexone, and Prucalopride
 - Natural agents such as ginger, herbal bitters and the botanical product Iberogast



Treating SIBO – Address the Cause

- Revisit the slide on risk factors and associated conditions. A few examples of addressing the cause may include:
 - Discontinuation of medications: To be discussed between patient and clinician (acid-blocking medications, meds that slow transit- opioid analgesics, etc.)
 - Treat Hypothyroidism
 - Treatment with Levothyroxine associated with greater incidence of SIBO
 - What is causing the hypothyroidism?
 - Hypochlorhydria
 - Bitters, Betaine HCl, etc.
 - What is causing the hypochlorhydria?
 - Some causes cannot be reversed (i.e. surgical alterations); ongoing management may be necessary.
 - Consider visceral manipulation for adhesions

www.siboinfo.com is an informative website maintained by Dr. Allison Siebecker, ND, and includes treatment considerations



Retesting

- In a patient treated for SIBO, many variables affect the decision of when to retest — including the patient's underlying condition and its severity, length of treatment, etc...
- The NA Consensus Group recommends that antibiotics should be avoided for 4 weeks prior to testing — this recommendation usually applies to initial testing for SIBO
- However, there are emerging clinical recommendations which suggest retesting patients within a few days of antimicrobial course completion to ensure efficacy of the treatment. The North American Consensus group as well as others suggest that 'breath tests may be performed shortly after cessation of antibiotic therapy to confirm eradication'



Case Examples

Case Example #1 Hydrogen positive,
mild methane positive

Case Example #2 Methane positive

Additional Scenario





Case Example #1

- 34 yo female with bloating and alternating diarrhea with constipation
- Symptoms ongoing since she caught a GI bug while traveling in Central America 9 months ago; did not experience these symptoms previously
- Certain foods are problematic and she finds herself eating more paleo to try to control symptoms
- Patient is very active and keeps busy with work and travel; the IBS symptoms have interfered with daily living





Case Example #1

- Hydrogen positive results
- Methane yellow – moderate
- Collection schedule followed correctly

Evaluation for Hydrogen (H ₂)			
<i>Hydrogen increase over baseline by 90 minutes</i>			
Change in H ₂	Result	Expected Value	
	58	<20 ppm	H
A rise of ≥ 20 ppm from baseline in hydrogen by 90 min should be considered a positive test to suggest the presence of SIBO.			

Evaluation for Methane (CH ₄)		
<i>Peak methane level at any point</i>		
CH ₄ Peak	Result	Expected Value
	7	<10 ppm
A peak methane level ≥ 10 ppm at any point is indicative of a methane-positive result.		

2337 Small Intestinal Bacterial Overgrowth (SIBO) 3 Hour - Breath
 Methodology: GC-TDC/SSS

Hydrogen (H₂) and Methane (CH₄) Breath Gases

Hydrogen (H ₂), Methane (CH ₄) and Carbon Dioxide (CO ₂) (ppm)								
	Baseline 0 min (S1)	20 min (S2)	40 min (S3)	60 min (S4)	90 min (S5)	120 min (S6)	150 min (S7)	180 min (S8)
H ₂	5	7	10	63	55	45	54	66
CH ₄	2	2	4	7	6	7	6	5
H ₂ + CH ₄	7	9	14	70	61	52	60	71
CO ₂ **	✓	✓	✓	✓	✓	✓	✓	✓

Actual Collection Times								
Actual Time	7:20	7:40	8:00	8:20	8:50	9:20	9:50	10:20
Actual Interval	0 min	20 min	40 min	60 min	90 min	120 min	150 min	180 min

**CO₂ is measured for quality assurance. ✓ indicates the CO₂ level is acceptable. ✗ indicates room air contamination exceeding acceptable limits.

Evaluation for Hydrogen (H ₂)		
<i>Hydrogen increase over baseline by 90 minutes</i>		
Change in H ₂	Result	Expected Value
	58	<20 ppm
A rise of ≥ 20 ppm from baseline in hydrogen by 90 min should be considered a positive test to suggest the presence of SIBO.		

Evaluation for Methane (CH ₄)		
<i>Peak methane level at any point</i>		
CH ₄ Peak	Result	Expected Value
	7	<10 ppm
A peak methane level ≥ 10 ppm at any point is indicative of a methane-positive result.		

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Case Example #1

- Treatment: Since the patient did have a mixed IBS-type picture with alternating diarrhea and constipation, the clinician chose to treat both methane and hydrogen-producing bacteria
 - Botanical regimen including Candibactin AR and BR plus Allimed (for methane) x 6 weeks
 - Begin low FODMAPs diet
 - Meal spacing every 4-5 hours
- Follow up: After 2 months, the patient symptoms had improved, so there was no follow up testing. The patient continued with the meal spacing and modified FODMAPs
 - The goal is not continuous FODMAPs, since fermentable carbohydrate is important to the health of the commensal bacteria of the large intestine. The goal would be to introduce fermentable carbohydrates/resistant starches over time



Case Example #2

- 66 yo male with bloating and excessive belching and flatulence
- Severe constipation for as long as he can remember
- Has up to 2 bowel movements per week that are difficult to pass, he considers this pattern normal for him
- Obese, hypertension, hypothyroid, diabetic
- Takes oxycodone daily for a back injury 3 years ago
- Eats a standard American diet





Case Example #2

- Methane-positive test
- Hydrogen normal
- Collection schedule followed correctly

Evaluation for Methane (CH ₄)			
Peak methane level at any point			
	Result		Expected Value
CH ₄ Peak	57	H	<10 ppm
A peak methane level ≥ 10 ppm at any point is indicative of a methane-positive result.			

2337 Small Intestinal Bacterial Overgrowth (SIBO) 3 Hour - Breath
 Methodology: GC-TDC/SSS

Hydrogen (H₂) and Methane (CH₄) Breath Gases

Hydrogen (H ₂), Methane (CH ₄) and Carbon Dioxide (CO ₂) (ppm)								
	Baseline 0 min (S1)	20 min (S2)	40 min (S3)	60 min (S4)	90 min (S5)	120 min (S6)	150 min (S7)	180 min (S8)
H ₂	7	13	7	9	6	5	9	10
CH ₄	44	56	47	57	45	38	42	45
H ₂ + CH ₄	51	69	54	66	51	43	51	55
CO ₂ **	✓	✓	✓	✓	✓	✓	✓	✓

Actual Collection Times								
Actual Time	7:20	7:40	8:00	8:20	8:50	9:20	9:50	10:20
Actual Interval	0 min	20 min	40 min	60 min	90 min	120 min	150 min	180 min

**CO₂ is measured for quality assurance. ✓ indicates the CO₂ level is acceptable. X indicates room air contamination exceeding acceptable limits.

Evaluation for Hydrogen (H ₂)		
Hydrogen increase over baseline by 90 minutes		
	Result	Expected Value
Change in H ₂	6	<20 ppm
A rise of ≥20 ppm from baseline in hydrogen by 90 min should be considered a positive test to suggest the presence of SIBO.		

Evaluation for Methane (CH ₄)		
Peak methane level at any point		
	Result	Expected Value
CH ₄ Peak	57	H <10 ppm
A peak methane level ≥ 10 ppm at any point is indicative of a methane-positive result.		

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Case Example #2

- Treatment:
 - The clinician chose to treat methane-producing organisms with Rifaximin plus Neomycin x 14 days
 - A prokinetic was prescribed – MotilPro (combination of ginger and 5HTP) indefinitely until chronic constipation resolves
 - Magnesium was prescribed daily to assist with regularity
 - Levothyroxine Rx was switched to Armour Thyroid
 - Recommended increasing water intake from 1 cup daily to at least 1-2 L daily
 - While fiber is important for constipation, it was avoided initially to address SIBO
 - Low carbohydrate diet recommended (for diabetes, obesity, and SIBO)



Case Example #2

- The long-term focus with this patient would be to work on his overall health conditions and habits that may predispose to SIBO (diabetes, hypothyroid, Standard American Diet, oxycodone use)
 - The recurrence of SIBO is common especially if underlying conditions are not addressed
 - This patient's lifestyle and health conditions are inflammation-promoting, so transitioning to anti-inflammatory diet/lifestyle may take time, in order to come off oxycodone
- A GI Effects Comprehensive stool analysis was also ordered for this patient
 - If there are other GI abnormalities, for example pancreatic insufficiency, then pancreatic enzymes can be given to help with digestion (pancreatic insufficiency is common with diabetes)



Additional Scenario: “Flatline Test”

- Low H₂ and CH₄ throughout the test could indicate:
 - It is a negative test for SIBO; consider other testing to assess etiology of patient symptoms
 - If both H₂ and CH₄ are low all 3 hours, it may suggest the presence of H₂S-producing bacteria
 - The H₂S-producing bacteria consume the H that would otherwise have gone to the bacteria that make H₂ or CH₄
 - H₂S smells like rotten eggs, so if this is what the patient experiences, this may be the case
 - The patient may not have followed collection pack instructions correctly
 - The breath didn’t make it into the tube
 - They may have just completed antibiotics
 - Instructions say wait 4 weeks after discontinuing antibiotics
 - Some clinicians may advise their patient to collect immediately after finishing antibiotics to ensure efficacy of treatment



GI Test Considerations

SIBO

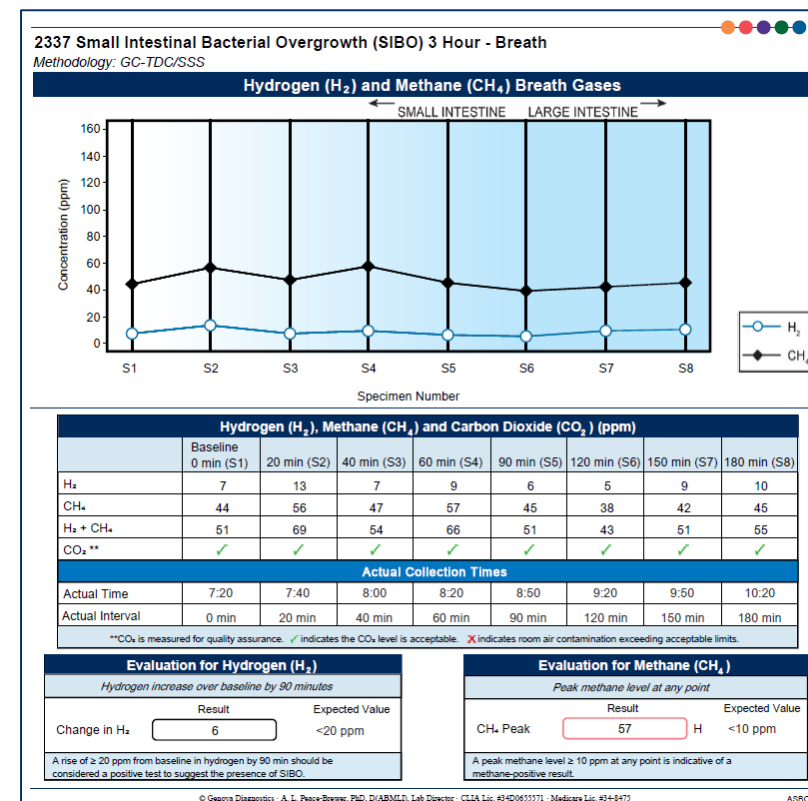
Other tests





Review: When to Order SIBO Testing

- IBS
- GI symptoms
- Bloating
- Intolerance to carbohydrates or FODMAPs
- Symptoms after eating
- Unexplained abdominal symptoms
- Predisposing conditions (see list)



It is important to designate someone in the office to go over collection package instructions with each patient to ensure optimal results



Other GI Test Considerations for Similar Symptoms

- GI Effects is comprehensive and can identify:
 - Pancreatic insufficiency
 - Inflammation
 - Dysbiosis
 - Yeast overgrowth
 - Parasitic infection
- Food Antibody panel
- Celiac and Gluten Sensitivity panel

Patient: Jane Doe
DOB: September 18, 1990
Sex: F
MRN:

Order Number:
Completed: October 05, 2013
Received: September 21, 2013
Collected: September 20, 2013

2200 GI Effects™ Comprehensive

INFECTION

Blastocystis hominis

DIVERSITY ASSOCIATION

Dairy

Casain	0
Cheddar cheese	VL
Cottage cheese	VL
Cow's milk	VL
Goat's milk	VL
Lactalbumin	0
Yogurt	VL

Fruits

Apple	0
Apricot	0
Banana	0
Blueberry	VL
Cranberry	0
Grape	1+
Grapefruit	1+
Lemon	0
Orange	0
Papaya	0
Peach	VL
Pear	0
Pineapple	0
Plum	VL
Raspberry	VL
Strawberry	VL

0 None Detected

GI Effects Stool Profiles

IgG Food Antibody Assessment

Patient: JANE DOE
Age: 17
Sex: F
MRN:

Order Number:
Completed: July 28, 2010
Received: July 18, 2010
Collected: July 18, 2010

Biomarker	Result	Reference Range
Total IgA	139.8 Sufficient	62.0-343.0 mg/dL
Anti-Tissue Transglutaminase IgA (TTG IgA)	2.1 Negative	<=4 U/mL
Anti-Deamidated Gliadin IgA (DGP IgA)	17.2 Negative	<=19 U/mL
Anti-Endomysial IgA (EMA IgA)	Not Detected	Not Detected
Anti-Gliadin IgA (AGA IgA)	21 Weak Positive	<20 U/mL
Anti-Gliadin IgG (AGA IgG)	32 Strong Positive	<20 U/mL

Interpretation

Patient results are consistent with Gluten Sensitivity.

```

graph TD
    TotalIgA[Total IgA] -- Normal --> TTG_DGP[TTG IgA and DGP IgA]
    TotalIgA -- Low --> HLA_DG2_DQB[HLA DQ2/DQ8]
    
    TTG_DGP -- Both Negative --> NOT_Celiac[NOT Celiac]
    TTG_DGP -- Either Positive --> EMA_IgA[EMA IgA]
    
    EMA_IgA -- Positive --> CELIAC[CELIAC]
    EMA_IgA -- Negative --> HLA_DG2_DQB
    
    HLA_DG2_DQB -- Negative --> NOT_Celiac
    HLA_DG2_DQB -- Positive --> Refer_Biopsy[Refer for Biopsy]
    
    NOT_Celiac --> NO_Gluten_Sensitivity[NO Gluten Sensitivity]
    CELIAC --> Gluten_Sensitivity[Gluten Sensitivity]
  
```



GI Effects[®] Comprehensive Profile

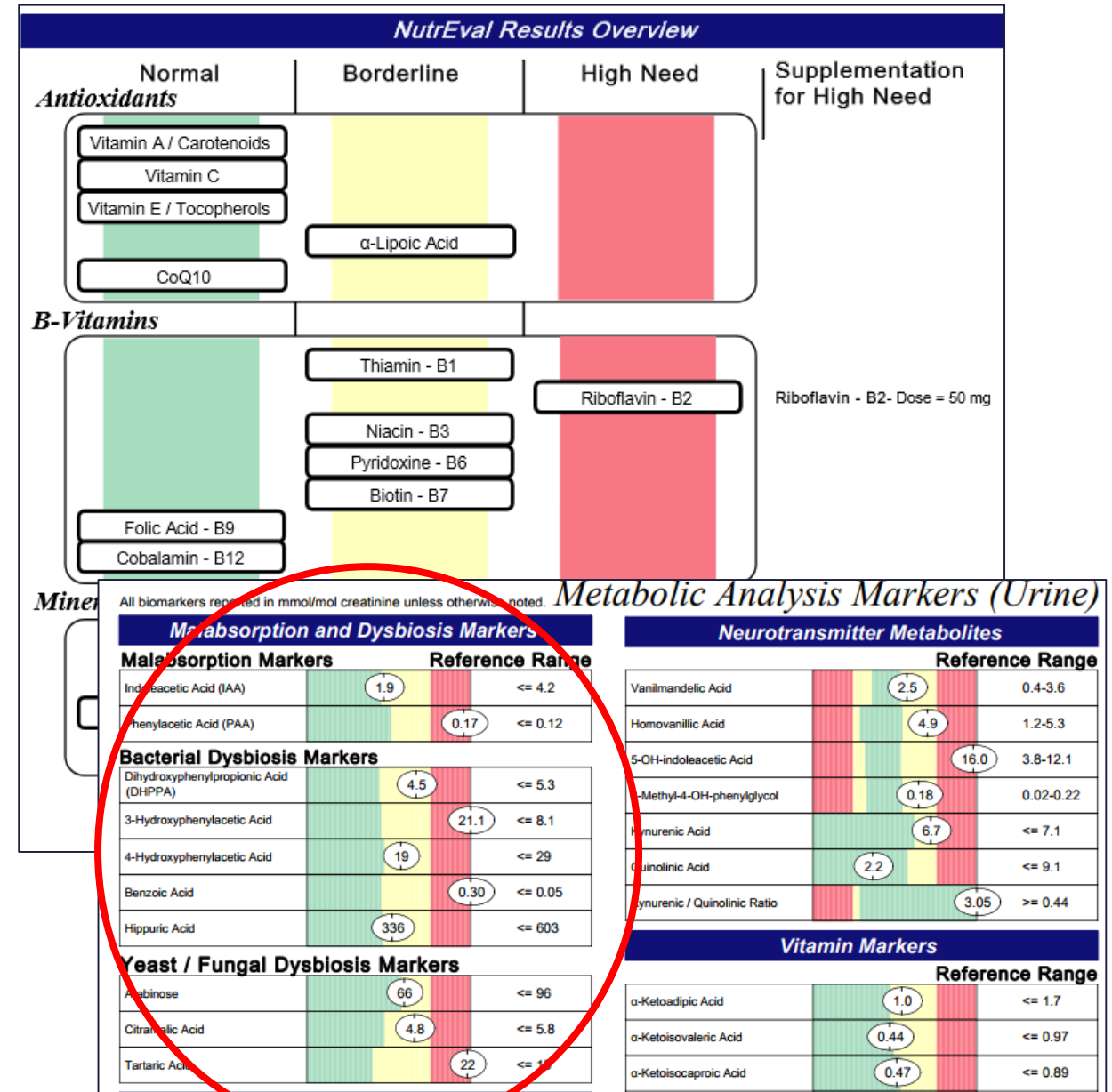
GI Effects profile can not diagnose Small Intestinal Bacterial Overgrowth

- There are markers on this profile that can be suggestive of SIBO in the right patient population:
 - Elevations in Products of Protein Breakdown
 - Elevations in Fecal Fats
 - Unexpected or extreme elevations in Total SCFAs and n-butyrate

Nutritional Insufficiencies

- B vitamins
- Macronutrients
- Fat-soluble vitamins

The NutrEval assesses urine organic acids including malabsorption and dysbiosis biomarkers





Lahnor Powell, ND, MPH
Moderator



Christine Stubbe, ND, FABNO
Presenter

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WWW.GDX.NET

*for more information and
educational resources, including...*

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LIVE GDX – Previous webinar recordings

GI University – Focused learning modules

Conferences – Schedule of events we attend

Test Menu – Detailed test profile information

MY GDX – Order materials and get results

Questions?





Additional Questions?

US Client Services: 800-522-4762

UK Client Services: 020-8336-7750

Please schedule a complimentary appointment with one of our Medical Education Specialists for questions related to:

- Diagnostic profiles featured in this webinar
- How Genova's profiles might support patients in your clinical practice
- Review a profile that has already been completed on one of your patients

We look forward to hearing from you!



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Small Intestinal Bacterial Overgrowth: Updates and Clinical Implications

Christine Stubbe, ND, FABNO