

# Colonoscopy does not induce small intestinal bacterial overgrowth

Ioana Gabriela Moraru, Dan Lucian Dumitraşcu

2<sup>nd</sup> Medical Department, "Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania

## Abstract

**Background and Aim:** Small intestinal bacterial overgrowth (SIBO) is associated with gastrointestinal pathology and colonoscopy. This endoscopic investigation could cause changes in gut flora including the occurrence of SIBO. We looked in this study for the effect of colonoscopy (preparation and intubation) on the occurrence of SIBO. **Materials and Methods:** Prospective study including thirty patients with irritable bowel syndrome (IBS) diagnosed according to Rome III criteria. Two groups were designed: Twenty IBS patients that performed colonoscopy (G1) and ten IBS patients (G2) not referred to colonoscopy. All patients have been tested for the presence of SIBO using glucose hydrogen breath tests (GHBT) at the beginning of the study, on day 1. G1 patients have also been tested before colonoscopy (day 2) and 1 week after (day 9). G2 patients performed GHBT on day 1 and on day 9. **Results:** The peak value of expired H<sub>2</sub> was assessed, and the mean value was calculated. There were no significant statistical differences between the mean H<sub>2</sub> values in the 2 groups of patients on day 1. The mean level of H<sub>2</sub> significantly decreased after preparing for colonoscopy in G1 patients ( $P < 0.0001$ ). There were no significant statistical differences between the mean levels of H<sub>2</sub> on day 2 versus day 9 in G1 patients ( $P = 0.176$ ). The mean level of H<sub>2</sub> 1 week after performing colonoscopy (7.65 ppm) is higher than that obtained after preparing for it (6.3 ppm), but no statistical significance. Patients from G2 showed no statistical differences between the mean levels of H<sub>2</sub> on day 1 versus day 9 ( $P = 0.6132$ ). Patients in G1 had a significantly lower mean H<sub>2</sub> level versus G2 patients on day 9. **Conclusions:** Colonoscopy does not produce SIBO. Preparing for colonoscopy influences the level of expired H<sub>2</sub>, it reduces the number of intestinal bacteria, probably through a mechanic effect or by inflating air during the procedure. Performing GHBT too soon after colonoscopy might result in false negative results of GHBT.

## Key words

Colonoscopy, H<sub>2</sub> breath test, small intestinal bacterial overgrowth

## Introduction

Intestinal microbiota (microflora or intestinal flora) defines the complex microbial ecosystem located at the intestinal level.<sup>[1]</sup> Any qualitative or quantitative change in intestinal


microbiota can have serious repercussions on humans. One of these changes is the appearance of small intestinal bacterial overgrowth (SIBO) syndrome.<sup>[2]</sup> SIBO is defined by the presence of  $\geq 10^5$  CFU/ml in the small bowel culture.<sup>[3]</sup>

The most common methods for diagnosing SIBO are represented by the hydrogen breath tests, using either lactulose or glucose.

### Address for correspondence:

Prof. Dan Lucian Dumitraşcu, 2<sup>nd</sup> Medical Department,  
Clinicilor Street, Number 3-5, Cluj-Napoca, Romania.  
E-mail: ddumitrascu@umfcluj.ro

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Colonoscopy is an investigation frequently performed in patients who need testing for SIBO. Therefore, it is important to know if colonoscopy can influence SIBO status. It has been shown by several authors that preparing for colonoscopy significantly reduces the level of exhaled H<sub>2</sub>, modifying the H<sub>2</sub>-BT results.<sup>[4,5]</sup> Performing H<sub>2</sub>-BT is usually recommended 4 weeks after colonoscopy, but studies on this subject have not yet established the time duration necessary for the intestinal flora to recover. It seems that preparing for colonoscopy reduces the number of intestinal bacteria.<sup>[5]</sup>

### Aim

We looked in this study for the effect of colonoscopy on SIBO status in patients with IBS. We aimed to know if colonoscopy (preparation and intubation) is causing SIBO in IBS patients as we also looked for the effect of colon cleansing agent on SIBO status.

## Methods

### Patients

We designed a prospective study of patients with IBS according to Rome III criteria.<sup>[6]</sup> Two groups were randomly created: A group of 20 IBS patients referred to colonoscopy (G1) and a group of 10 IBS patients (G2) not referred to colonoscopy. Any organic or biochemical diagnosis was ruled out according to a comprehensive work-out including previous colonoscopy, evaluation for malabsorption, hyperthyroidism, and any other confounding conditions. Demographic data of the subjects are displayed in Table 1.

We have excluded from the study all patients with any organic disorder with similar symptoms or comorbidities: Intestinal tumors, inflammatory bowel disease, celiac disease, diabetes, and cirrhosis, intestinal, pancreatic, or gastric resections that could possibly lead to SIBO. We have also excluded patients that used in the last month drugs that interfere with intestinal motility (prokinetics, antispasmodic) or intestinal flora (antibiotics, probiotics).

All subjects included in the study signed an informed consent. The study was approved by the local ethics committee.

**Table 1: Demographic data of the patients included in the study**

	G1	G2	P
Mean age (years)	33.5	32.5	NS
Gender	11F/9M	5F/5M	NS
Mean symptom duration (years)	1	1.2	NS

G1=Group1, G2=Group 2, F=Female, M=Male, NS=No significant statistical difference

### Protocol

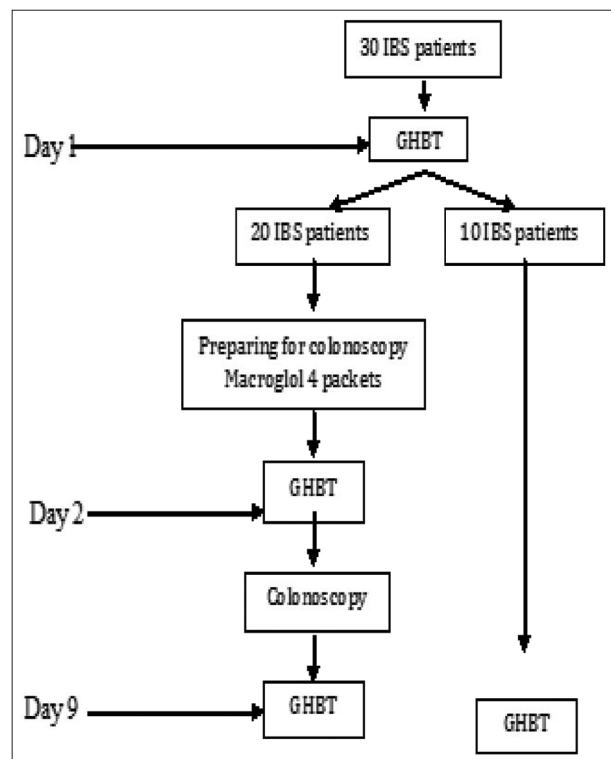
All 30 IBS patients included in the study were subjected for a glucose hydrogen breath test (GHBT) on day 1, at the base point. Patients have consequently been divided into two groups: G1 = 20 patients that, after performing GHBT, started preparing for colonoscopy using macrogol 4000–64 g/packet. They were submitted next day, day 2, in the morning, to colonoscopy. Just before performing the colonoscopy, all 20 patients have been submitted to another GHBT. One week after performing the colonoscopy, on day 9, GHBT was repeated again.

G2 included a number of 10 IBS patients that performed a GHBT on day 1 and 9. In this group, neither colon cleansing nor colonoscopy was performed [Figure 1].

### Glucose hydrogen breath test

According to the indications of the Rome Consensus group,<sup>[7]</sup> we have used in our study 50 g glucose in 250 ml water. The test was performed in the morning, on an empty stomach, after at least 1 day of carbohydrates free diet. Patients were asked not to smoke 2 h before the test and during the test,<sup>[8]</sup> not to chew gum or to perform any physical exercise,<sup>[5]</sup> all of the above being able to modify the level of breath H<sub>2</sub>. They were also asked to disinfect their mouth with chlorhexidine just before the test.

After a baseline sample of expired air, patients were asked to ingest substrate and breath sampled were analyzed at 15 min



**Figure 1:** IBS: Irritable bowel syndrome, GHBT: Glucose hydrogen breath test

interval, for 120 min. If the baseline value of H2-BT is >16 ppm (parts per million), the patient is excluded from the study. The test is considered positive if there is a clear H2 peak, exceeding 20 ppm before the 120 min.

**Preparation for colonoscopy**

All 20 IBS patients included in G1, after performing GHBT, have started preparing for colonoscopy-4 packets of polyethylene glycol (PEG), macrogol 64 g/packet, 1 packet in 1 l water. Between 18 o'clock and 20 o'clock, patients were asked to drink 2 l water with 2 packets and between 2 o'clock and 4 o'clock, the rest. All colonoscopies were performed in the morning, starting at 10 o'clocks, immediately after performing the day 2 GHBT. After performing colonoscopy 2 patients have been diagnosed with left colonic diverticulosis, 3 with megacolon and 1 patient presented 2 polyps of 3-4 mm; we performed endoscopic polypectomy in this case.

**Statistics**

Statistical data processing and graphic representation of the results were been performed using Excel XLSTAT (from Microsoft Office 2007) application and Statistica 7 from STAT Soft Inc (Dell Statistica, 2300 East 14<sup>th</sup> Street Tulsa). Comparing group results has been performed using variant analysis, and the statistical significance of the contingency tables was been evaluated by means of Fischer or Chi-square test. *P* < 0.05 was considered significantly statistic. The significance threshold for the tests was set at *P* < 0.05 as statistical significant difference.

**Results**

There were no significant statistical differences between patients included in the two groups (G1 and G2) regarding age, gender, and medium duration of symptoms [Table 1].

All patients have been divided into subgroups, according to the dominant IBS symptom, with no significant statistical difference between the numbers of patients in each subgroup [Figure 2].

All 30 IBS patients included in the study performed GHBT on day 1. For every patient, we have determined the peak value of breath H2, and we have calculated the mean value. There were no significant statistical differences between the mean H2 values, of the two groups of patients, G1 versus G2 on day 1 [Table 2].

Among patients in the G1, 2 of them (10%) have been diagnosed with SIBO (H2 >20 ppm) and no patient from G2.

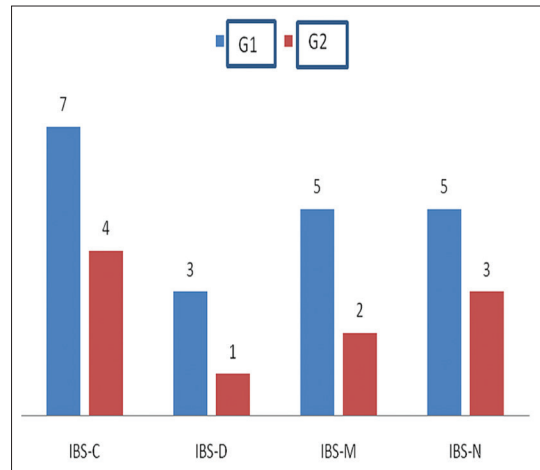
All 20 G1 patients, after performing GHBT, started preparing for colonoscopy using PEG 4 packets. The next morning (day 2) at 8 o'clock, they performed another GHBT. The mean level of H2 after preparing for colonoscopy was significantly lower that the level noted before PEG ingestion (*P* < 0.0001) [Table 3]. No patient presented with SIBO after PEG administration.

All 20 G1 patients started performing colonoscopy at 10 AM in the morning. One week after colonoscopy, all patients, G1 and G2, performed another GHBT. Using *post hoc* analysis and variance analysis, we obtained significant statistical differences between the levels of H2 on day 1 versus day 9 (*P* < 0.0001), but no statistical differences between the levels of H2 on day 2 versus day 9 in G1 patients (*P* = 0.176) [Figure 3].

The mean level of H2 1 week after performing colonoscopy (7.65 ppm) is higher than that obtained after preparing for it (6.3 ppm), but the difference has no statistical significance.

Regarding G2 patients, there were no statistical differences between the mean levels of H2 in day 1 versus day 9 (*P* = 0.6132) [Table 4].

Using variance analysis, there were significant statistical differences between the levels of H2 in G1 versus G2 in day 9, patients from G1 presenting a much lower H2 level [Table 5].



**Figure 2:** G1-Group 1, G2-Group 2, IBS-C: Irritable bowel syndrome with constipation, IBS-D: Irritable bowel syndrome with diarrhea, IBS-M: Irritable bowel syndrome mixed symptoms, IBS-N: Irritable bowel syndrome unspecified symptoms

**Table 2: H2 level in day 1**

	Mean H2 level (ppm)	Patients number	Standard deviation	Fischer test	P
G1	11.9	20	4.49	0.339166	0.5650 (NS)
G2	11	10	2.62		
Total	11.6	30	3.94		

G1=Group1, G2=Group 2, NS=No significant statistical difference

**Table 3: H2 level in day 1 versus day 2 in Group 1 patients**

	Mean H2 value (ppm)	Number of patients	Standard deviation	P
Day 1	11.9	20	4.49	<0.0001
Day 2	6.3	20	1.92	

**Table 4: H2 level in day 1 versus day 9 in Group 2 patients**

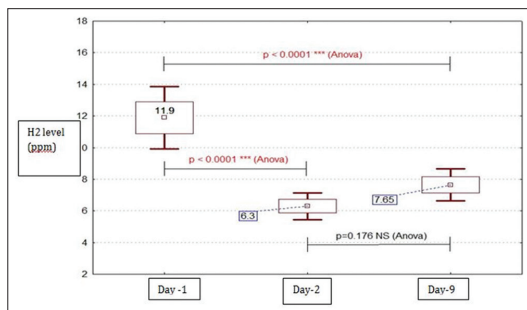
	Mean H2 value (ppm)	Patients number	Standard deviation	Fischer test	P
Day 1	11	10	2.62	0.264706	0.6132 (NS)
Day 9	10.40	10	2.69		

H2=Hydrogen, ppm=Parts per million, G2=Group 2, NS=No statistical significant difference

**Table 5: H2 on day 9 in both groups**

	Mean H2 value (ppm)	Number of patients	Standard deviation	Fischer test	P
G1	7.65	20	2.30	8.770840	0.0062
G2	10.40	10	2.59		

ppm=Parts per million, G1=Group 1, G2=Group 2



**Figure 3:** H2 mean level in G1 patients in day 1, day 2 and day 9. H2=Hydrogen, \*\*\*Very significant statistical difference, NS=No significant statistical difference

## Discussions

IBS, one of the most frequently diagnosed functional gastrointestinal diseases all over the world, still represents a challenge in treatment and diagnosis.<sup>[9]</sup> SIBO was diagnosed in 4%–78%<sup>[10-14]</sup> of patients with IBS, making it a putative etiological factor.

Colonoscopy is indicated in almost all IBS patients. The effect of colon cleansing for colonoscopy and of the colonoscopy itself on the SIBO is still debated. More recently, same authors that used H2-BT to establish the quality of colon preparation for colonoscopy have underlined the decrease on H2 level after the preparation.<sup>[15]</sup>

Therefore we have performed a study on IBS patients that were evaluated by means of H2-BT and colonoscopy. In this study, we have obtained a significant reduction in exhaled H2 level after PEG ingestion (11.9 ppm vs. 6.3 ppm,  $P < 0.0001$ ), data that correspond to those obtained by other authors. Recently, in a study from 2014, a group of Italian experts, has obtained the same H2 level reduction after preparing for colonoscopy ( $11 \pm 1.8$  ppm vs.  $1.8 \pm 0.3$  ppm,  $P < 0.001$ ).<sup>[15]</sup> Another study performed on 18 IBS patients, using lactulose BT, revealed

the same H2 level reduction after preparing for colonoscopy ( $P < 0.05$ ).<sup>[16]</sup>

Preparing for colonoscopy was performed with PEG, macrogol, with a medium molecular weight of 3350 Da. It is an osmotic laxative that does not determine absorption or secretion of electrolytes in the intestinal lumen and that due to his molecular weight is not absorbed in the intestines and is not digested by the intestinal flora. It acts by eliminating the fecal matters trough a mechanical effect, secondary to increasing their volume. The decrease in H2 level after PEG is probably due to his quantitative effect on the intestinal bacterial flora, reducing the number of bacteria, followed by a reduction in H2 level produced by those bacteria.<sup>[15,16]</sup>

There were two patients in the G1 group diagnosed with SIBO (H2 level  $>20$  ppm). After PEG ingestion, no patient presented with SIBO and a significant reduction in the H2 breath level was noted. H2-BT should not be performed immediately after preparing for colonoscopy to avoid their false negative results.

One week after colonoscopy all patients repeated GHBT, the level of H2 still being lower than the one found in day 1. The level is slightly elevated then the one in day 2 but the difference is not statistically significant, probably suggesting the beginning of the intestinal bacterial restore process. In our study, colonoscopy does not induce bacterial overgrowth. It seems that performing H2-BT 1 week after colonoscopy can result in false negative results, probably 4 weeks proposed by the Rome Consensus group<sup>[7]</sup> between the 2 investigations is reasonable, but more studies are still needed.

We have noted a significant difference between the levels of H2 on day 9 in the two groups G1 and G2 patients that performed colonoscopy, G1 showing a much-decreased level. It was suggested by some authors that inflating air during colonoscopy can reduce the number of intestinal anaerobe bacteria, consequently decreasing the level of H2.<sup>[17]</sup>

A limitation of our study is the relatively small sample; new studies, on larger patient populations, followed for a longer period to determine the changes in intestinal H2 level are needed.

## Conclusions

Colonoscopy does not induce SIBO. The level of exhaled H2 significantly decreases after preparing for colonoscopy (11.9 ppm vs. 6.3 ppm,  $P < 0.0001$ ) and is maintained as such at least 1 week after colonoscopy. Performing H2-BT immediately after preparing for colonoscopy can result in false negative result for the H2-BT.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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