

# Intestinal Bacterial Overgrowth After Roux-en-Y Gastric Bypass

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**Abstract** The aim of the present study was to report the occurrence of serious subnutrition, associated to intestinal bacterial overgrowth, in two patients submitted to bariatric surgery. Two female patients (body mass index, 49 and 50 kg/m<sup>2</sup>, respectively) were submitted to Y-en-Roux gastric bypass. The first patient evolved a 52% loss of body weight within 21 months after surgery; the other, a 34% loss of initial body weight within 15 months after surgery, results corresponding, respectively, to 62 and 45 kg weight losses. However, both patients reported asthenia, hair fallout, and edema, and one also reported diarrhea, but none was feverish. Their respective albuminemias were of 24 and 23 g/l. A respiratory hydrogen test suggested

bacterial hyperproliferation. Thirty days after ciprofloxacin and tetracyclin treatments, they showed improved albumin levels and nutritional states, both confirmed by results of hydrogen breath tests. Bacterial overgrowth is an important complication that can compromise clinical evolution of patients submitted to intestinal surgery like gastroplasty with Y-Roux anastomosis. In cases of clinical suspicion or a confirmed diagnosis, adequate antibiotics, sometimes requiring to be cyclically repeated, should be administered.

**Keywords** Poor absorption · Bacterial overgrowth · Bariatric surgery

## Introduction

Bariatric surgery is presently one of the most effective available treatments of obesity showing a considerable grow rate over the last years. Approximately 16,000 of such surgeries had been performed in the USA in the early 1990s. One decade later, this number had risen to nearly 103,000 [1]. However, this procedure does not remain free from medical complications [2] divided into early and late stages. The former are mainly related to the surgical procedure itself, whereas the latter are associated with malnutrition, hypovitaminosis, anemia, dehydration, and some mineral salts deficiencies, all capable of leading to gastrointestinal dysfunctions like nausea or vomiting, diarrhea, abdominal pain, intestinal obstruction, ulcers, stenosis, biliary lithiasis, constipation, and incision herniation [3].

Here reported are two cases of obese patients submitted to bariatric surgery using a 100-cm Roux limb, and based

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on data showing superior weight loss with extended versus short Roux limbs, in severely obese patients. According to a standard procedure, the stomach was divided, creating a 30-ml gastric pouch; the small bowel was divided at an approximately 100-cm distal length from the ligament of Treitz, creating a 100-cm Roux. A side-to-side jejunojejunostomy was performed to reestablish intestinal continuity. The Roux limb was brought into a retrocholic and retrogastric positions, and an anastomosis to the gastric pouch was performed. These procedures led subjects to evolve pictures of malnutrition and clinically suggestive bacterial overgrowth.

### Case 1 Report

A female 25-year-old patient with a previous history of obesity since infancy has been previously submitted to various clinical treatments associated to drugs for appetite reduction that had shown therapeutic faults. On February 2005, she weighed 131 kg and had a body mass index of 49 kg/m<sup>2</sup>. After medical and psychological evaluation, bariatric Y-Roux surgery was indicated. Multivitamin and mineral supplementation, as well as nutritional orientation, was post-operationally provided (Table 1). The patient showed a weight loss of 62 kg, 53% of her pre-operative weight within 21 months after surgery, but complained of asthenia, weakness, skin pallor, shineless hair, hair loss,

**Table 1** Listing of useful multivitamins and minerals supplied to the patients

Compound	Amount
Vitamin A	5,000 UI
Colecalciferol (Vitamin D3)	400 UI
Ascorbic acid (Vitamin C)	100 mg
Folic acid	1 mg
Tocopherol acetate (Vitamin E)	30 UI
Biotin	30 µg
Pyridoxin hydrochloride (B <sub>6</sub> )	10 mg
Cianocobalamine (B <sub>12</sub> )	12 µg
Niacinamide	20 mg
Riboflavin (B <sub>2</sub> )	3.4 mg
Thiamine monohydrate (B <sub>1</sub> )	3.0 mg
Pantothenic acid	10 mg
Chrome chloride	25 µg
Calcium carbonate	250 mg
Iron fumarate	60 mg
Sodium molybdate	25 µg
Magnesium oxide	25 mg
Manganese	5 mg
Zinc oxide	25 mg
Potassium iodide	150 µg
Copper oxide	2 mg

edema, flatulence, and diarrhea with fetid feces at six to ten episodes per day. Laboratory evaluation showed hypoalbuminemia (24 g/l) and anemia (hemoglobin 10g/dl); a hyperproteic diet was prescribed, but no satisfactory clinical response was achieved.

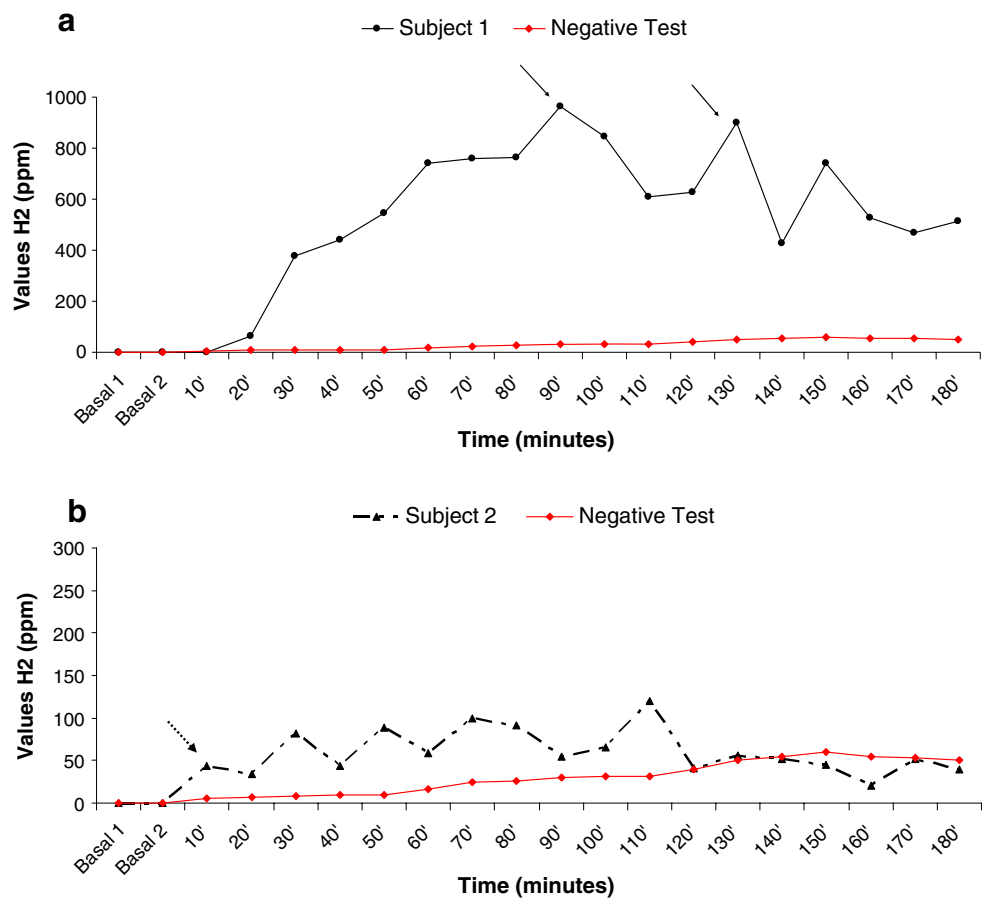
The patient was then taken to the Division of Clinical Nutrition of the Ribeirão Preto School of Medicine for clinical evaluation. On admission, she was under a diet rich in plain carbohydrates, associated to a diet of high lipid content. Physical examination showed faded mucosae, break-prone opaque hair, and depressive edema. Data of laboratory examinations are summarized on Table 1. They show hypoalbuminemia, normocytic and normochromic anemia, hyperferritinemia, lowered capacity for total iron binding, and raised folic acid levels. After correction of the alimentary mistakes, diarrhea episodes were reduced, but the patient still presented a frequency of around six evacuations per day and was submitted to investigation for malabsorption. Qualitative testing for the presence of fat in feces, was negative; test of xylose revealed unaltered results (4.4 g h<sup>-1</sup>, reference values >4 g h<sup>-1</sup>). She was not using antacid or antibiotic drugs, and surgical complications creating partial intestinal obstruction or stasis were ruled out, as were HIV/AIDS or other serious immune deficiencies. Radiological evaluation of intestinal transit time was normal; however, she presented diffuse dilatation of small intestinal loops, in contrast to the exclusive loop from the distal ileum onwards.

A hydrogen breath test with an overload of 80 g of glucose was performed with the aim of eliminating a picture of bacterial hyperproliferation: curved lines resulting from this test shown in Fig. 1a suggested bacterial overgrowth. The patient was submitted to antimicrobial therapy and given 500 mg/day of ciprofloxacin. After 14 days, diarrhea had improved, although persisting with two to three diarrheic daily episodes. Treatment with tetracycline was installed for another 14 days, and after 2 months, the patient had evolved full resolution of the diarrhea associated to an improved nutritional state (Table 2). The hydrogen breath test was then repeated. Figure 2 illustrates the areas under the curve of the hydrogen test performed before and after antibiotic treatment: cycle area reduction can be observed. After hospital discharge, she evolved satisfactorily and maintained an improved nutritional state.

### Case 2 Report

This case refers to a 28-year-old female with controlled hypertension (presents arterial pressure of 110×80 mmHg), diabetic, obese since childhood, worsening 10 years ago after a pregnancy. Over the last 16 years, she had been

**Fig. 1** Result of the hydrogen breath tests. **a** Subject 1 exhibits double peaks: the first after 90 min, followed by a drop of more than 5 ppm over three following cycles and a second peak after 130 min (*black arrow*). **b** Subject 2 presented an increase of more than 40 ppm after an overcharge by 80 g of glucose, maintaining raised results for up to 90 min (*dotted arrow*). The red line represents the curve of a test considered normal

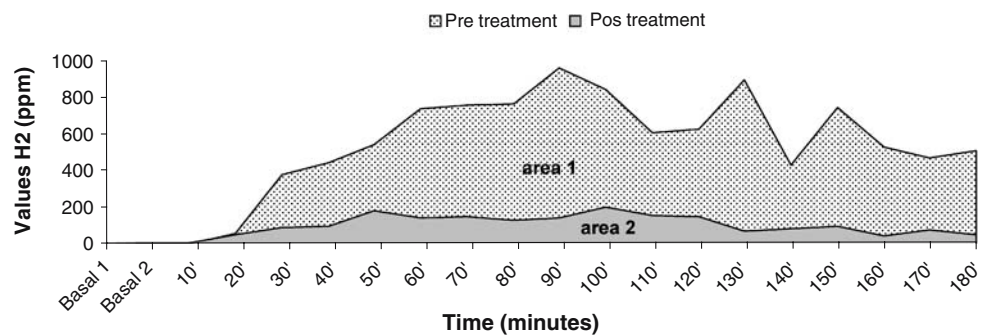


**Table 2** Laboratory evaluation prior to and after patient submission to the antibiotic cycle

	Patient 1		Patient 2		RV
	Admission	Post-treatment	Admission	Post-treatment	
Albumin (g/l)	24	33	23	27	35–50
Total proteins (g%)	4.4	5.2	5.1	6.1	6–8
Hemoglobin (g%)	10	11	7.9	10.2	11.5–15
Hematocrit (%)	32	34	24	32,5	38–48
VCM (m <sup>3</sup> )	93	98	95	102.6	82–96
Lymphocytes (mm <sup>-3</sup> )	1.784	2.340	2.100	2.500	1.200–2.400
Vitamin B12 (pg/ml)	404	206	404	954	330–1025
Folic acid (ng/ml)	>24	19	10.9	16.5	5–21
UIBC (mg/dl)	94	235	5	15	112–346
Iron (mg%)	100	80	94	113	50–150
Ferritin (ng/ml)	194	264	338	349	6–150
AST (U/l)	19	13	32	29	15–37
ALT (U/l)	34	16	23	49	30–65
Gama-GT (U/l)	46	35	65	81	5–85
Alk. Phosphatase (U/l)	209	196	213	247	50–136
INR	1.4	1.0	1.3	1.2	≤1.2
Urea (mg%)	22	22	15	28	15–40
Creatinine (mg/dl)	0.8	0.6	0.8	0.7	0.7–1.5

RV Reference values

**Fig. 2** Comparison of the areas of the curve before and after antibiotic therapy. Area 1 represents the period before antibiotic treatment, and area 2 represents the post-treatment period



submitted to unsuccessful anti-obesity clinical treatments. Before bariatric surgery, the patient had used anti-hypertensives (Captopril 50 mg/day, hydrochlorothiazide 25 mg/day) and oral hypoglycemics (glybenclamide 5 mg/day and metformin 1.700 mg/day); they were suspended on the eighth postoperative month. At pre-operation, she weighed 133 kg with a body mass index of 51 kg/m<sup>2</sup>. Submitted to Y-en-Roux gastric bypass, she evolved a weight loss of 45 kg (34% of her initial weight) over the 15 months after surgery.

The patient was taken to the Division of Clinical Nutrition from Ribeirao Preto School of Medicine for clinical evaluation. On admission, she was under a diet rich in plain carbohydrates, associated to a diet of high lipid content. On physical examination, faded mucosae, break-prone opaque hair, and depressive edema were noted.

Results of laboratory examination, summarized in Table 1, showed hypoalbuminemia (23 g/l) associated to anemia (hemoglobin 7.9g/dl) normal serum iron levels, besides a positive SUDAM (++/++++), suggesting malabsorption. Results of hydrogen test breath suggested bacterial hyperproliferation. Treatment with ciprofloxacin for 14 days (Fig. 1b) led to improved clinical and laboratory parameters (Table 2). After being discharged, she evolved well and maintained an improved nutritional state.

## Discussion

The here described patients presented clinical signs of protein malnutrition associated to anemia, but did not show clinical or images suggesting steatohepatitis. After extensive investigation, their clinical signs were ascribed to bacterial overgrowth, and they were submitted to appropriate antibiotic therapy. Bacterial overgrowth is one of the complications related to diarrhea caused by the existence of the excluding loop in patients submitted to Y-en-Roux bariatric surgery. It occurs when a lack of equilibrium between the colonic flora and pathogenic bacteria is present. When untreated, it can evolve into malnutrition, anemia, and the poor absorption syndrome [4]. There are

studies reporting risk of its evolution to non-alcoholic steatohepatitis, especially in cases of obesity [5, 6].

The causes of anemia in patients with bacterial overgrowth must be investigated in relation to poor food absorption. As a rule, patients evolve with secondary megaloblastic anemia caused by vitamin B12 deficiency [7]. In the present cases, we observed that despite hemoglobin improvement after antibiotic therapy, increased average corpuscle volume also occurred, associated to a lowering of vitamin B12 serum levels. Fobi–Capella gastroplasty can also contribute to the appearance of this type of anemia, rendering it necessary to supplement B12 vitamin to most bariatric surgery patients [7, 8]. One of our patients presented increased serum levels of folic acid, which may be explained by increased folate production by small intestine bacteria [9]. Another clinical signal that could suggest fat-soluble vitamin (vitamin K) deficiency was the widened INR on admission, which became normalized after treatment. In this case, patients presented clinical symptoms of vitamin A and D deficiencies, which are common complications of the absorption syndrome caused by poor fat absorption, consequent to the lack of bile salts. Vitamin A deficiency leads in general to night blindness. Vitamin D deficiency can precipitate osteomalasia, osteoporosis, tetany, and hypocalcemia [8]. One of our patients was submitted to spinal (ADMO L2–L4= 1.030 g/cm<sup>2</sup>), hip (ADMO=0.973 g/cm<sup>2</sup>), and femur (ADMO=0.896 g/cm<sup>2</sup>) densitometry that eliminated a clinical picture suggestive of osteopenia.

Bacterial overgrowth is defined as a bacterial population in the small intestine exceeding 10<sup>5</sup>–10<sup>6</sup> microorganisms per milliliter [9]. Breath tests with xylose and/or glycolic acid labeled with <sup>13</sup>C or <sup>14</sup>C isotopes followed by spectrophotometry can be applied. Another exam is the breath hydrogen test that consists of offering the patient 10 g of lactulose or 50–80 g of glucose in 120–200 ml water, followed by the collection of samples of final expiration every 10–30 min during 3 to 4 h [9]. Criteria for positive results are increases of 10–12 parts per million (ppm) after 50 g of glucose or 20 ppm after lactulose during the first 40 min. Increased basal values can also suggest

bacterial overgrowth [10, 11]. Another criterion is the presence of double peaks, one of them at the first 90 min of the test, followed by a drop of more than 5 ppm of other two consecutive samples and by a second peak representing substrate entrance into the colon [12].

The treatment in this case consisted of correcting complications associated with malnutrition, plus antibiotic therapy, with the objective of modifying the intestinal flora and generating symptom remission; however, these can return after suspension of the treatment, and subjects may need recurring courses of antibiotic treatment [9, 13, 14]. Recommended antibiotics are ciprofloxacin, norfloxacin, metronidazol, amoxicilin, tetracyclin, cloramphenicol, and neomicin for 7 to 10 days. In the present study, patient 1 partially responded to a dose of 500 mg ciprofloxacin every 12 h. A new therapeutic cycle with 250 mg tetracycline every 6 h led to total remission of all symptoms. Patient 2 responded clinically to ciprofloxacin monotherapy.

Thus, bacterial overgrowth diagnosis and treatment contributes to a better clinical evolution after bariatric surgery.

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