

## Clinical Science

# Pre-resection gastric bypass reduces post-resection body mass index but not liver disease in short bowel syndrome



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**KEYWORDS:**

Short bowel syndrome;  
Gastric bypass;  
Obesity;  
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**Abstract**

**BACKGROUND:** Obese patients developing short bowel syndrome (SBS) maintain a higher body mass index (BMI) and have increased risk of hepatobiliary complications. Our aim was to determine the effect of pre-resection gastric bypass (GBP) on SBS outcome.

**METHODS:** We reviewed 136 adults with SBS: 69 patients with initial BMI < 35 were controls; 43 patients with BMI > 35 were the obese group; and 24 patients had undergone GBP before SBS.

**RESULTS:** BMI at 1, 2, and 5 years was similar in control and GBP groups, whereas obese patients had a persistently increased BMI. Eight (33%) of the GBP patients had a pre-resection BMI > 35, but post-SBS BMI was similar to those <35. Obese patients were more likely to wean off PN (47% vs 20% control and 12% GBP,  $P < .05$ ). Radiographic fatty liver tended to be higher in the GBP group (54% vs 19% control and 35% obese). End-stage liver disease occurred more frequently in obese and GBP patients (30% and 33% vs 13%,  $P < .05$ ).

**CONCLUSIONS:** Pre-resection GBP prevents the nutritional benefits of obesity but does not eliminate the increased risk of hepatobiliary disease in obese SBS patients. This occurs independent of pre-SBS BMI suggesting the importance of GBP itself or history of obesity rather than weight loss.

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It is somewhat paradoxical that an increasing number of patients who develop intestinal failure because of short bowel syndrome (SBS) have a history of morbid obesity.<sup>1</sup> Morbidly obese individuals may develop SBS as a complication of bariatric procedures, particularly gastric bypass (GBP), secondary to internal hernia, intestinal obstruction from adhesions, and mesenteric ischemia.<sup>2</sup> As more

patients have undergone bariatric procedures, we are now seeing more patients for small bowel transplantation evaluation who have sustained a catastrophic loss of bowel months to years after an initial bariatric operation. Mortality data from the Italian Society of Obesity Surgery – the largest database on bariatric surgery worldwide, published in 2007 – reported that 2 of the 34 deaths were because of internal hernia and intestinal ischemia but no data on intestinal failure were reported.<sup>3</sup>

We have recently demonstrated that pre-resection body mass index (BMI) influences post-resection BMI in SBS patients.<sup>1</sup> Patients who were obese before developing SBS

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tended to remain obese. These obese SBS patients are also at increased risk of hepatobiliary disease if receiving parenteral nutrition (PN).<sup>4</sup> Thus, obesity appears to be an important determinant of outcome in the SBS.

In our initial study, a small sample of patients with surgically induced weight loss before SBS maintained BMI and % ideal body weight (IBW) similar to nonobese patients despite initial increased BMI.<sup>1</sup> It is unclear if this phenomenon is simply related to weight loss after GBP with a lower BMI at the time of developing SBS or because of other factors related to either the GBP itself or previous obesity. Our aim was to further examine the effect of pre-resection GBP on post-resection BMI and evaluate the incidence of liver disease in these SBS patients.

## Methods

This was a retrospective review of 136 adult patients with SBS evaluated at our institution between 1990 and 2010 and stratified by BMI at the time of developing SBS. Sixty-nine patients with initial BMI < 35 were controls. Forty-three patients with initial BMI > 35 were the obese group. Twenty-four patients had undergone GBP before SBS. Patients with malignancy, previous radiation therapy, and Crohn's disease were excluded from the study.

SBS was defined as an intestinal remnant <180 cm in length with associated malabsorption. Intestinal anatomy was classified as Type 1 (end jejunostomy), Type 2 (jejunocolic anastomosis), and Type 3 (jejunum–ileocolic anastomosis).<sup>5</sup> Patients under our management were treated with a consistent diet based on intestinal anatomy and had a similar PN weaning protocol. They were encouraged to achieve a minimum of 80% of their assessed oral requirements, generally at a level of basal energy expenditure  $\times$  1.3 for activity factor  $\times$  1.3 for a malabsorption factor. Weight parameters (% IBW and BMI) were evaluated at 1, 2, and 5 years after developing SBS.

Patient age and sex, underlying cause of resection, presence of other risk factors for liver disease, status of the intestinal remnant and other digestive organs, presence of hepatobiliary disease pre- and post-resection, and nutritional management and outcome were determined. Diabetes mellitus (DM) was defined as the clinical diagnosis and treatment of Type 2 diabetes. Bacterial overgrowth was documented by intestinal cultures with  $>10^5$  bacteria/mL. Central line infections were defined as an episode of culture-proven infection and antibiotic treatment. Chronic alcohol use was defined as  $>1$  drink/day for  $>1$  year. Chronic PN was defined as continued requirement for PN  $>1$  year after developing SBS.

Hepatobiliary disease was evaluated by serum liver function tests, radiologic imaging (ultrasound and computed tomography), endoscopic findings (portal hypertension), and histologic evaluation of liver biopsies. Fibrosis was determined histologically by the presence of bridging fibrosis. Fatty liver was a radiographic diagnosis made by computed

**Table 1** Comparison of SBS patient groups

	BMI < 35	BMI > 35	Gastric bypass total
Number	69	43	24
Age (y)	19–84	21–82	27–67
Sex			
Female	39 (57%)	28 (65%)	20 (83%)
Male	30 (43%)	15 (35%)	4 (17%)
Diagnosis			
Postoperative	36 (52%)	21 (49%)	22 (92%)*
Mesenteric vascular disease	21 (30%)	16 (37%)	1 (4%)
Other	12 (17%)	6 (14%)	1 (4%)
Medical history			
Bacterial overgrowth	16 (23%)	6 (14%)	5 (21%)
Diabetes mellitus	5 (7%)	12 (28%) <sup>†</sup>	6 (25%) <sup>†</sup>
Central line infection	34 (49%)	24 (56%)	11 (46%)
Chronic alcohol use	3 (4%)	4 (9%)	0 (0%)
Hepatitis	2 (3%)	2 (5%)	0 (0%)

BMI = body mass index; SBS = short bowel syndrome.

\* $P < .05$  versus BMI < 35 and BMI > 35.

<sup>†</sup> $P < .05$  versus BMI < 35.

tomography with moderate to severe steatosis. Cirrhosis/portal hypertension was determined by a combination of clinical findings, radiographic studies, and histology, including ascites, hepatosplenomegaly, cirrhosis by radiologic and histologic studies, and esophageal varices. End-stage liver disease (ESLD) was defined as chronic, severe hyperbilirubinemia ( $>6$  mg/dL), hypoalbuminemia ( $<2.5$  g/L), and clinical or histologic evidence of cirrhosis or other clinical signs of liver failure. Statistical comparisons were made using analysis of variance and chi-square tests, as appropriate, with  $P < .05$  signifying statistical significance.

## Results

The 24 surgical patients had all undergone Roux en Y GBP, of which 9 were open and 15 were laparoscopic. SBS developed within 30 days after the procedure in 1 patient and between 14 and 300 months in the others. BMI ranged from 38 to 85 before GBP and from 21 to 68 at the time of developing SBS. Sixteen (66%) patients have had gastric continuity reinstated. Five (21%) underwent distal gastrectomy. Three (13%) have not undergone gastric reconstruction.

The 3 groups were similar with respect to age and sex (Table 1). A higher proportion of GBP patients had postoperative SBS. The incidence of history of hepatitis, chronic alcohol use, bacterial overgrowth, and central line infection was similar in all 3 groups. Patients with BMI < 35 were less likely to have DM. Intestinal remnant length, anatomy type, and presence of the colon were also similar (Table 2).

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