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Making sense of gastric/intestinal bypass surgeries: forget the name and remember the degree of restriction and malabsorption the surgeries provide

The field of bariatric surgery is becoming more difficult to understand for young bariatric surgeons, bariatric physicians, and patients because of the different names used for bariatric surgeries that involve small intestinal rerouting. In addition to the different names, the stomach size and limb length for these bariatric surgeries make it difficult to judge whether they are restrictive or malabsorptive in nature. Furthermore, patients are left confused in the decision-making process when they consider undergoing a gastric/intestinal bypass surgery or revisional bariatric surgery after weight recidivism.

For example, 2 decades ago, if a patient was considering undergoing a surgery involving small bowel rerouting, the term for that surgery most likely would have been Roux-en-Y gastric bypass (RYGB) or biliopancreatic diversion (BPD) [1,2]. In contrast, today, if a patient is considering a surgery that involves small bowel rerouting, this could mean any of the following bariatric surgeries: one anastomosis gastric bypass/mini gastric bypass (OAGB/MGB), BPD or BPD-duodenal switch (DS), single anastomosis duodenoileostomy (SADI), single anastomosis gastroileostomy (SAGI), single anastomosis sleeve ileostomy (SASI), duodenojejunal bypass (DJB), or stomach intestinal pylorus sparing surgery (SIPS) [2–9].

To add to the confusion, several randomized controlled trials have compared restrictive and malabsorptive surgeries rather than comparing surgeries within the same category (either restrictive or malabsorptive) [10–14]. For example, Lee et al. compared RYGB with OAGB/MGB, and Mingrone et al. and Risstad et al. compared RYGB with BPD/BPD-DS for diabetic patients and patients with super-obesity, respectively. All these authors concluded that OAGB/MGB and BPD are superior to RYGB in weight loss and co-morbidity resolution at the expense of more micronutrient and macronutrient deficiency. One would not be surprised that malabsorptive surgeries provide superior weight loss and co-morbidity resolution at the expense of more malnutrition. It would make sense to compare restrictive surgeries together, like what was done by Schauer et al. and Peterli et al. when they compared RYGB and laparoscopic sleeve gastrectomy in diabetic and morbidly obese patients, respectively [13,14].

To be able to make any sense of all these different bariatric surgeries involving small bowel rerouting, one must consider what all these surgeries have in common rather than what makes them different. For example, all these different surgeries involve some degree of gastric restriction in decreasing order (BPD, BPD-DS, SADI, SIPS, DJB, SASI, OAGB/MGB, RYGB), with a variable length of biliopancreatic limb in decreasing order (RYGB, OAGB/MGB, DJB, SASI, SIPS, SADI, BPD-DS, BPD) and a shorter alimentary limb (common channel with or without a Roux limb) (Tables 1 and 2). Hence the best way to understand how these surgeries work is by measuring the size of the new stomach (size of bougie used and length of the gastric pouch) and the length of the alimentary limb (common channel plus the Roux limb), common channel, and biliopancreatic limbs. In addition, given that the small bowel length is variable, whenever performing any surgery with restriction and/or malabsorption, one must consider keeping the length of the common channel constant and always consider measuring from the ileocecal valve (BPD, BPD-DS, SADI, SASI, SAGI, and SIPS) rather than measuring from the ligament of Treitz (OAGB/MGB and DJB) (see Tables 1 and 2).

To help simplify the decision process, it is more practical to define all bariatric surgeries that involve no malabsorption, such as RYGB, as restrictive surgeries when explaining bariatric surgeries that include small bowel rerouting to patients, bariatric physicians, and surgeons. Similarly, all surgeries that involve malabsorption should be defined as malabsorptive surgeries (OAGB/MGB, BPD/BPD-DS, SADI, SAGI, SASI, DJB, and SIPS). In addition, malabsorptive surgeries should be subdivided into surgeries with a moderate (OAGB/MGB, DJB) or severe degree of malabsorption (BPD/BPD-DS, SADI, SAGI, SASI, and SIPS). This distinction is important because one surgery is not suitable for all patients. For example, morbidly obese

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Table 1
Bariatric surgeries that involve small bowel rerouting and gastric restriction

Assuming small bowel length of 600 cm	BPD	BPD-DS	SADI	OAGB/MGB	DJB	RYGB
Approximate stomach size (mL)	250–400	150 (50 Fr bougie)	150 (50 Fr bougie)	120 (36–40 Fr bougie)	150 (40 Fr bougie)	30
Roux limb length (cm)	200	150	N/A	N/A	N/A	100
Common channel (cm)	50	100	250	400	350	450
Alimentary limb (cm)	250	250	250	400	350	550
BPL (cm)	350	350	350	200	250	50

BPD = biliopancreatic diversion; BPD-DS = biliopancreatic diversion-duodenal switch; BPL = biliopancreatic limb; DJB = duodenojejunal bypass; OAGB/MGB = one anastomosis gastric bypass/mini gastric bypass; RYGB = Roux-en-Y gastric bypass; SADI = single anastomosis duodenoileostomy.

patients (body mass index <50 kg/m^2) experience better weight loss and less weight recidivism compared with patients with superobesity (body mass index >50 kg/m^2) or patients with weight recidivism after restrictive bariatric surgeries. In contrast, bariatric surgeries that provide restriction combined with some degree of malabsorption (BPD/BPD-DS, OAGB/MGB, SADI, SASI, SAGI, DJB, and SIPS) are more suitable for patients with superobesity or patients in whom restrictive surgeries failed [15–18]. In addition, the decision process involves weighing weight recidivism against the development of micronutrient and macronutrient deficiency. Furthermore, as shown by Nergaard et al., lengthening the biliopancreatic limb can transform RYGB into a malabsorptive surgery [19]. Hence it is more important to categorize surgeries with gastric/intestinal bypass into restrictive or malabsorptive by measuring the size of the stomach and the limb lengths rather than sticking to the name of a surgery.

Some degree of weight recidivism after bariatric surgeries is the expectation rather than the exception [1,15-18]. In addition, restrictive bariatric surgeries result in more weight recidivism than do bariatric surgeries with restriction and malabsorption. Furthermore, some restrictive bariatric surgeries (laparoscopic sleeve gastrectomy and laparoscopic adjustable gastric banding) result in more weight recidivism than do other restrictive surgeries, such as RYGB [1,15-18].

RYGB in its standard form with a short biliopancreatic limb of 30 to 50 cm is considered the gold standard for bariatric surgery and it should be regarded as a restrictive surgery [1,15,19–21]. Nergaard et al. demonstrated in a recent randomized controlled trial that an RYGB with a longer biliopancreatic limb behaves like a malabsorptive bariatric surgery with better weight loss and more micronutrient deficiency [22]. Furthermore, Srikanth et al. demonstrated superior results by after RYGB when they lengthened the biliary limb and shortened the common channel in patients with weight recidivism after restrictive surgeries [23]. Hence, what matters is not the name of the surgery, but rather the limb lengths and the size of the stomach. In addition, RYGB with short biliopancreatic and very long alimentary limbs (Roux limb plus common channel) is not suitable for patients with superobesity and does not produce acceptable results for patients with weight recidivism after restrictive bariatric surgeries (see Tables 1 and 2) [15–18]. So, it is not a surprise that RYGB is no longer the most commonly performed bariatric surgery in the United States, Europe, and Asia for several reasons [24] including the steep learning curve, the potential for development of internal hernia, and more importantly, the paucity of options to revise outcomes of patients with weight recidivism after RYGB. Historically, bariatric surgeons have added malabsorption to treat patients with weight recidivism after RYGB, resulting in a significant degree of protein calorie malnutrition (PCM) [25–27]. However, adding malabsorption to an RYGB by elongating the Roux limb (Brolin et al.) or the biliopancreatic limb (Sugerman et al., Fobi et al., Canuana et al.) can lead to very different weight loss results and different incidences of PCM (Brolin et al.: 7.4% versus 100% with a 50 cm common channel; Sugerman et al.: 43.7% with a 150 cm common channel; Fobi et al.: 23%; Canuana et al.: a range from 0%–40%) [25–29]. In addition, OAGB/MGB despite its larger stomach pouch leads to more weight loss, better co-morbidity resolution, and more micronutrient deficiency compared with RYGB [11]. Furthermore, a recent randomized controlled trial by Risstad et al. confirmed what

Table 2
Bariatric surgeries that involve small bowel rerouting and gastric restriction

Assuming small bowel length of 400 cm	BPD	BPD-DS	SADI	OAGB/MGB	DJB	RYGB
Approximate stomach size (mL)	(250–400)	150 (50 Fr bougie)	150 (50 Fr bougie)	120 (36–40 Fr bougie)	150 (40 Fr bougie)	30
Roux limb length (cm)	200	150	N/A	N/A	N/A	100
Common channel	50	100	250	200	150	250
Alimentary limb	250	250	250	200	150	350
BPL	150	150	150	200	250	50

BPD = biliopancreatic diversion; BPD-DS = biliopancreatic diversion-duodenal switch; BPL = biliopancreatic limb; DJB = duodenojejunal bypass; OAGB/MGB = one anastomosis gastric bypass/mini gastric bypass; RYGB = Roux-en-Y gastric bypass; SADI = single anastomosis duodenoileostomy.