

Original article

Mid-term outcomes of gastric bypass weight loss failure to duodenal switch

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Abstract

Background: The Roux-en-Y gastric bypass (RYGB) is a very effective treatment for obesity and its related co-morbidities. However, some patients fail to achieve >50% of their excess weight loss (EWL), and others regain much of the weight that they lost.

Objective: The purpose of this study was to analyze early outcomes after conversion of RYGB to duodenal switch (DS) in terms of weight loss, change in co-morbidities, and complications.

Setting: This is a retrospective analysis from 1 surgeon at a single private institution.

Methods: We analyzed data from 32 obese patients retrospectively who underwent revision for failed RYGB. Nine patients underwent DS with Roux-en-Y reconstruction (RYDS), and 23 patients underwent single anastomosis DS between October 2012 and December 2015. Regression analyses were performed for all follow-up weight-loss data.

Results: The patients experienced mean EWL of 16.2% over an average of 16 years (range: 0–38) with their primary RYGB surgery. Of 32 patients who underwent revision DS, 22 patients are beyond the 1-year postoperative mark (follow-up 81.8%), and 15 patients are beyond the 2-year postoperative mark (follow-up 73.3%). One patient was lost to follow-up. The patients experienced mean EWL of 31.2%, 45.1%, 51%, 54.2%, 56%, and 56.4% at 3, 6, 9, 12, 18, and 24 months, respectively, after their revisional surgery. Mean total weight loss achieved at 12 and 24 months was 27.7% and 29.2%, respectively. There was no statistical significant difference in mean %EWL at 12 months ($P = .468$) and 24 months ($P = .266$) between RYDS and single anastomosis DS.

Conclusion: A laparoscopic revision from RYGB to DS is an effective weight-loss operation with midterm follow-up of 2 years. Though long-term follow-up is warranted to measure recidivism, the initial data seem favorable. (Surg Obes Relat Dis 2016;12:1663–1670.) © 2016 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Revision laparoscopic duodenal switch; Failed Roux-en-Y gastric bypass; Weight loss failure; Weight regain; Recurrent co-morbidity; Revision surgery

Bariatric surgery improves quality of life and obesity-related co-morbidity, leading to a reduction in long-term mortality in morbidly obese patients [1,2]. The Roux-en-Y gastric bypass (RYGB) is the most studied bariatric procedure worldwide and is widely considered the gold

standard in bariatric surgery [3]. However, despite the successful outcomes of RYGB, weight recidivism is becoming a significant issue. Long-term follow-up studies have shown high weight-loss failure rates after this procedure [4].

The duodenal switch (DS) is a surgical weight-loss procedure utilizing both restrictive and malabsorptive methods to achieve long-term weight loss [5]. The first part is a sleeve gastrectomy that permanently removes part of the

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stomach. Its outcomes are well known and characterized [6,7]. Next, a long section of small intestine is bypassed to limit absorption of food. Perhaps most importantly, the pylorus is preserved to help maintain consistent blood sugars [8].

Weight loss failure, weight recidivism, and recurrent comorbidities after RYGB are challenging problems for bariatric surgeons today [9,10]. We believe that weight regain is not necessarily the patient's fault; just as some people do not tolerate the lap band, others cannot lose weight and maintain weight loss without a pylorus. In these instances, conversion to a DS is a well-tolerated operation for patients who have failed other bariatric operations [11–13].

Methods

This is a retrospective analysis from 1 surgeon at a single private institution. Each patient who enters the practice consents to have their de-identified data analyzed. The authors certify that the manuscript did not involve the use of animal or human patients. Since this is a retrospective study, formal consent is not required.

Each patient signed a specific informed consent that detailed the risks of revisional surgery as well as consent for their DS. In the case of the single-anastomosis duodenal switch (SADS) and Roux-en-Y reconstruction duodenal switch (RYDS), there were separate consent forms with diagram illustrations. Each patient was encouraged to watch actual videos of the revisional procedure that was discussed.

From our database, 32 patients were seen for weight recidivism or weight-loss failure after RYGB in the last 4 years. Failure of RYGB was defined as not losing or not maintaining >50% weight loss at 18 months postoperatively. Patients who met the criteria for RYGB failure were given various revision surgery options and, after detailed discussion with the surgeon, 32 patients chose to undergo laparoscopic revisional DS.

All patients underwent revisional DS surgery between October 2012 and December 2015. Preoperative data and postoperative outcome data (weight loss, co-morbidity resolution, complications, and mortality) were obtained from a prospectively kept database. Co-morbidities included were sleep apnea, diabetes, hypertension, and gastroesophageal reflux disease. An upper gastrointestinal endoscopy or upper gastrointestinal series was performed on all patients preoperatively to evaluate the appropriateness of the revision.

Of the 32 patients, 9 underwent laparoscopic RYDS with a 150-cm common channel and a 150-cm Roux limb, while 23 patients underwent laparoscopic SADS with a 300-cm common channel. At each visit, all patients were seen by a registered dietitian, who offered behavior modification suggestions and vitamin and mineral supplements made by Bariatric Advantage (Aliso Viejo, CA) and designed especially for DS. These supplements included fat-soluble vitamins, water-soluble vitamins, iron, zinc,

copper, and calcium citrate. However, we have no information regarding the compliance of patients using our prescribed regimen.

We stopped performing the RYDS in 2013 and performed only SADS thereafter. In the United States, we began doing the SADS in 2013 after having done RYDS since 2011. We were satisfied with the weight loss of the RYDS but unsatisfied with the frequency of diarrhea, smelly stools, flatulence, and vitamin deficiencies of copper and zinc seen in our practice.

Statistical Methods

Postoperative weight-loss data were analyzed using non-linear regressions. All statistical analysis was run through Sigma Plot statistical software (Systat; Chicago, IL).

Operative Technique

All of our procedures were done at a single time point. We have not performed staged procedures for RYGB to RYDS or SADS. The surgery began with placement of 5 trocars under direct vision. Adhesions were taken down, and then the Roux limb was resected off the gastric pouch (Fig. 1B: step 1 and 2), and the pouch was checked endoscopically for viability. If the patients had a Roux limb longer than 50 cm, we excised it back to 15 cm from the jejunojejunostomy. If it was 50 cm or less, we left the Roux limb alone. The resected small bowel was then removed from the abdominal cavity (Fig. 1B: step 3).

The gastric remnant was mobilized and the fundus resected (Fig. 1B: step 4). The remnant was attached to the gastric pouch using a totally hand-sewn method, a partially hand-sewn method, or an end-to-end anastomosis (EEA) method (Fig. 1B: step 5). These methods are all similar to gastric bypass gastrojejunal anastomosis techniques [14]. This was checked with endoscopy for patency and viability and performance of an air leak test.

Once this was accomplished and the ileocecal valve was located, either a 150-cm common channel and 150-cm Roux or a 300-cm common channel were created (Fig. 1B: step 6).

At this point, dissection began and the sleeve gastrectomy was done over a 40 French bougie without staple line reinforcement or oversewing (Fig. 1B: step 7). This was done away from the gastrogastrostomy. If the stomach was already very narrow, as was often seen from long-time disuse, then minimal resection was done of the body and antrum so as to maintain viable blood supply. The stomach was then taken out of the abdominal cavity.

The duodenal bulb was dissected 3 cm from the pylorus circumferentially and transected using an Endo GIA stapler (Covidien, Minneapolis, MN) (Fig. 1B: step 8) [15]. The duodenal stump was oversewed using a polydioxanone suture. Next, the limb was brought up sewn to the duodenal stump using 2.0 polysorb sutures (Fig. 1B:

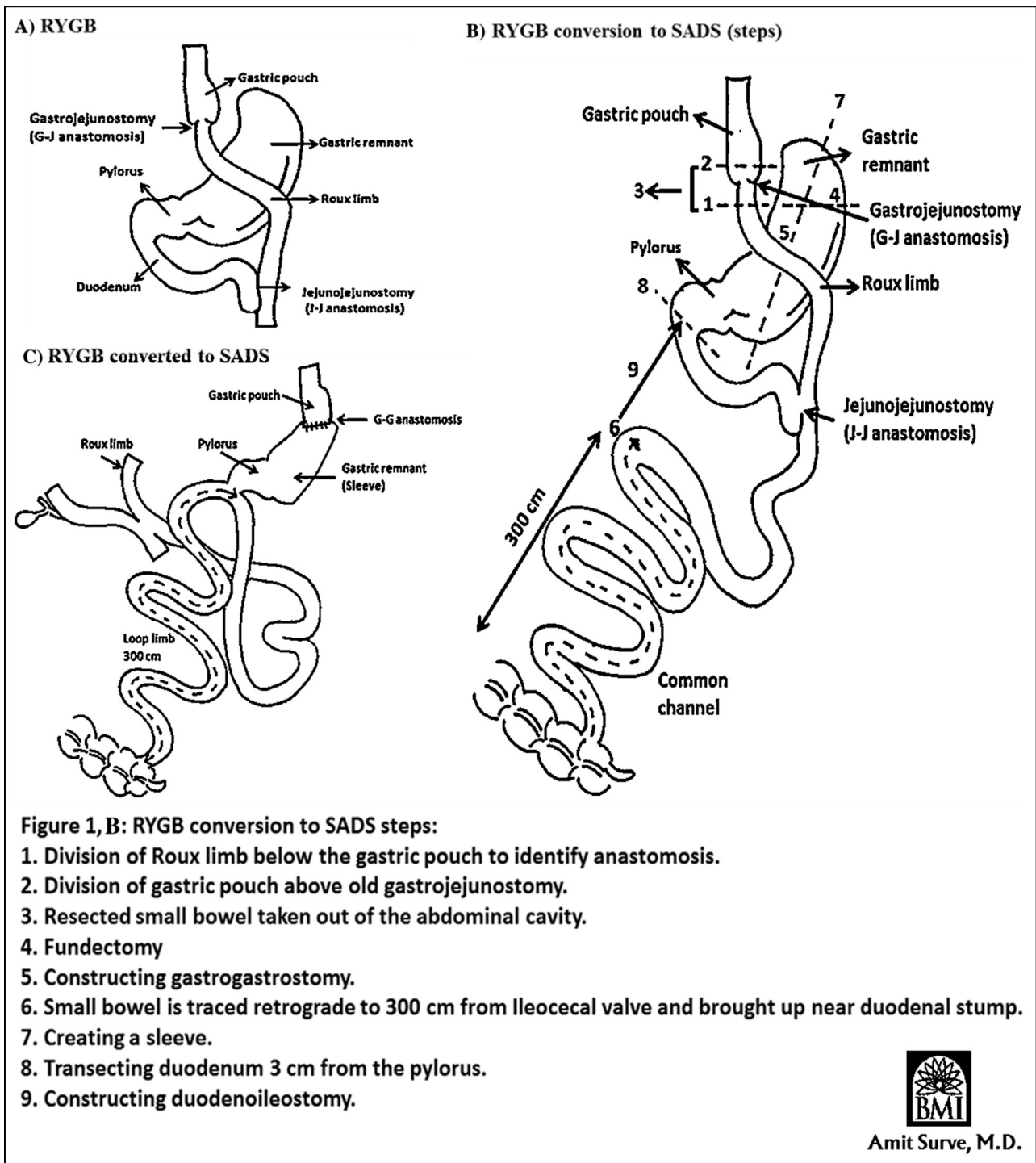


Fig. 1. Hand-drawn sketches of (A) Roux-en-Y gastric bypass (RYGB), (B) RYGB conversion to single-anastomosis duodenal switch (SADS) (steps), and (C) RYGB converted to SADS.

step 9). Enterotomies were made in both limbs, and 3.0 polysorb sutures were used to do another posterior row. An anterior row was also done using 3.0 polysorb sutures. The bowel was inspected for bleeding and bowel damage, and 2 large drains were placed. The skin was closed with staples, and the drains were sewn into place.

Results

A total of 32 patients were identified for analysis. The preoperative characteristics and operative details for revision DS are shown in Table 1. Twenty-two patients are beyond the 1-year postoperative mark, 18 of whom have data (81.8%). Fifteen patients are beyond the 2-year

Table 1
Characteristics and operative details of patients undergoing revision DS surgery from 2012–2015

Characteristic	Value
Patients (n)	32
Male/Female (n)	2/30
Primary RYGB	
Pre RYGB weight (lbs)	315.5 ± 106.14
Pre RYGB BMI (kg/m ²)	51.21 ± 14.33
Time to reoperation (yr)*	16.4 ± 9.3
Revision DS	
Age (yr)*	49.6 ± 9.4
Follow-up (mo)*	15 ± 11.1
Preoperative weight (lbs)	281.2 ± 73.8
Preoperative BMI (kg/m ²)*	45.6 ± 10.7
Ideal weight (lbs)*	128.2 ± 13.5
Excess weight (lbs)*	153 ± 70.4
Operative Details (Revision DS)	
No. of patients undergoing laparoscopic RYDS	9
No. of patients undergoing laparoscopic SADS	23
Operating time (min)*	155.5 ± 38.6
Blood loss (cc)*	40.5 ± 22.7
Length of stay (d)*	3.4 ± 1.8

DS = duodenal switch; RYGB = Roux-en-Y gastric bypass; BMI = body mass index; RYDS = Roux-en-Y reconstruction duodenal switch; SADS = single-anastomosis duodenal switch

*Values expressed as mean ± SD.

postoperative mark, 11 of whom have data (73.3%). One patient was lost to follow-up.

Complications post-laparoscopic revision DS are shown in Table 2. There were 5 (15.6%) readmissions within 30

Table 2
Short-term and long-term complications with revision DS

Short-term			Long-term		
Complications	RYDS (n = 4/9, 44.4%)	SADS (n = 4/23, 17.3%)	Complications	RYDS (n = 2/9, 22.2%)	SADS (n = 3/23, 13%)
Abdominal abscess: 2 [‡]	1	1	Gastric ulcer: 1 [†]	0	1
Peritonitis: 3 [‡]	2	1	Internal hernia: 1 [§]	0	1
Acute blood loss anemia: 1	1	0	Stricture: 1 [¶]	1	0
Gastric leak: 1	0	1	Small bowel obstruction:	0	1
			1 T/B		
Gastric outlet obstruction: 1 ^{**}	0	1	Sepsis: 1	1	0

DS = duodenal switch; RYDS = Roux-en-Y reconstruction duodenal switch; SADS = single-anastomosis duodenal switch.

[‡]Both the patients with abdominal abscess needed readmission within 30 days of discharge. Both underwent exploratory laparotomy with gastric lavage.

[†]Patient had recurrent ulcers and strictures needing esophagogastroduodenoscopy (EGD) with dilation.

[‡]Two patients had peritonitis on postoperative day 2. Both patients had leak from small bowel, requiring repair of small bowel enterotomy. One patient was readmitted within 30 days of discharge with gastrogastric anastomotic leak, causing peritonitis and needing repair.

^{||}This patient was also readmitted within 30 days of discharge with gastric leak.

[§]Patient presented 3 months postrevision SADS with abdominal pain. Exploratory laparotomy was performed with reduction of small bowel and closure of internal hernia.

[¶]Patient had stricture of the sleeve due to external scar tissue; therefore, no dilation was needed. Only adhesiolysis was performed.

^{**}Two years post-DS, patient presented with severe abdominal pain. CT scan revealed intussusception. Exploratory laparotomy was performed and dilation of jejunojejunostomy from old RYGB was found as one of the causes. Resection of Roux limb was carried out with side-to-side isoperistaltic enteroenterostomy between biliopancreatic limb and afferent limb. A kink at loop duodenal ileostomy on the afferent side was also found as the other cause of small bowel obstruction. A side-to-side enteroenterostomy was performed.

^{**}Patient experienced severe abdominal pain within 30 days of discharge and was diagnosed with gastric outlet obstruction caused by adhesion near pylorus. Adhesiolysis was performed for this patient.

days of discharge. Early complication rate was 25%. There was no 30-day mortality in any patient and 1 death was noted over a year, not related to surgery.

Success was defined as weight loss ≥50% of excess weight, and failure was defined as <50% of excess weight after 1 year of surgery [16–18]. Based on this definition, of the 18 patients who had their last available follow-up >1 year postoperatively, 14 (77.7%) were successful in terms of both weight loss and co-morbidity resolution (Table 3).

Postoperative nutritional data such as vitamins A, B-1, B-12, D, serum calcium, and albumin were also analyzed. The labs were available for total of 14 (63.6%) patients. Overall mean values for the nutritional data were close to normal (refer to Table 4).

Weight-loss analysis

Primary surgery (RYGB): The patients lost a mean excess weight of 16.2% over an average of 16 years (range: 0–38; Fig. 2).

Revision DS: Patients had experienced mean losses of 31.2%, 45.1%, 51%, 54.2%, 56%, and 56.4% of their excess weight at 3, 6, 9, 12, 18, and 24 months, respectively (Table 5).

RYDS: The 9 patients who underwent RYDS lost 64.6% of their mean excess weight at 12 months (follow-up: 62.5%) and 67.5% at 24 months (follow-up: 57.1%).

Table 3

Outcomes in patients postrevision DS (last available follow-up > 1 yr)

Pt no.	Pre- RYGB BMI (kg/m ²)	No. years after RYGB	Last available follow-up since revision DS (mo)	Pre revision DS BMI (kg/m ²)	Current BMI (kg/m ²)	% Excess Weight Loss post-revision DS	Outcomes
1	44.5	-	16	44.6	27	70.8	Successful
2	48	-	21	47.7	30.6	63.8	Successful
3	72.8	17	24	66.5	32.1	75.8	Successful
4	-	19	24	32.2	22.6	77.1	Successful
5	-	30	21	49.8	24.9	84.9	Successful
6	41.6	31	24	41.7	38.4	23.7	Failure
7	48.2	24	25	40.3	27.1	67.3	Successful
8	56.5	25	13	51	43	43.5	Failure
9	47.8	25	13	48.6	40.7	27.9	Failure
10	46.9	19	39	45.6	32.8	52	Successful
11	51.6	20	21	43	26.5	76.5	Successful
12	-	31	26	55	55	0	Failure
13	36.6	20	32	33.8	22.8	82.8	Successful
14	-	13	12	39.4	27.7	64.4	Successful
15	48.2	24	25	40.3	27.1	67.3	Successful
16	-	12	25	66	33.3	70.7	Successful
17	56.4	2	25	35.7	24.3	75.7	Successful
18	35.9	7	31	38.1	26.5	69.2	Successful

DS = duodenal switch; RYGB = Roux-en-Y gastric bypass; BMI = body mass index.

According to the definition of success, of 18 patients who had their last available follow-up > 1 year postop, 14 (77.7%) were successful in terms of weight loss.

SADS: The 23 patients who underwent SADS lost 52.8% of their mean excess weight at 12 months (follow-up: 92.8%) and 54.5% at 24 months (follow-up: 87.5%).

There was no statistically significant difference in mean percent excess weight loss at 12 months ($P = .468$) or 24 months ($P = .266$) between RYDS (9 patients) and SADS (23 patients).

Discussion

RYGB is the one of the most successful bariatric procedures. It provides durable weight loss for years. However, up to 25% of patients fail to maintain their

weight loss [19–22]. These failure rates have remained consistent over time [23–25].

The question remains for the surgical practitioner what options are available for the 25% who have failed to maintain their weight loss after RYGB. Various surgeons have tried revising the stoma or pouch size or lengthening the Roux limb to create a distal bypass (none of these have experienced short-term or long-term success) [26,27].

The question for those who do not perform the DS is why this should work when a distal bypass does not. We believe this is all related to the pylorus. When RYGB patients come to clinic after weight-loss failure they almost always are eating small, frequent, high-carbohydrate meals. We believe this is a physiologic response to vacillating blood sugar

Table 4

Nutritional outcomes in patients postrevision DS

	Albumin	Calcium	Vitamin B1	Vitamin B12	Vitamin A	Vitamin D
Pre-revision DS						
Value*	3.9 ± .4	9.3 ± .5	128.3 ± 54.4	405.8 ± 285	40.5 ± 14.8	23.9 ± 13.5
Range	3–4.5	8.4–10.5	32.6–251.4	148–1589	30–51	5.3–60
Abnormal Labs (n)	3/32	1/32	3/32	3/32	1/32	14/32
≥6 mo (n: 17/27)						
Value*	3.8 ± .8	9 ± .6	146.4 ± 49.7	716.4 ± 721.5	39.3 ± 15.4	45.7 ± 27.7
Range	2–4.3	7.8–9.9	81.3–208.4	281–2000	25–57	18.9–96
Abnormal Labs (n)	2/17	1/17	0/17	0/17	0/17	3/17
≥12 mo (n: 14/22)						
Value*	3.6 ± .9	8.9 ± .8	100.9 ± 34.6	742.5 ± 425	36 ± 12.9	45.1 ± 27.7
Range	1.7–4.6	7.8–10.3	50–147.2	384–1459	24–57	11–96
Abnormal Labs (n)	3/22	5/22	1/22	2/22	0/22	2/22
Normal Range	3.5–5.5 g/dL	8.5–10.2 mg/dL	74–222 nmol/L	200–1100 pg/mL	24–90 ug/dL	25–80 ng/mL

DS = duodenal switch.

*Values are expressed as mean ± standard deviation.

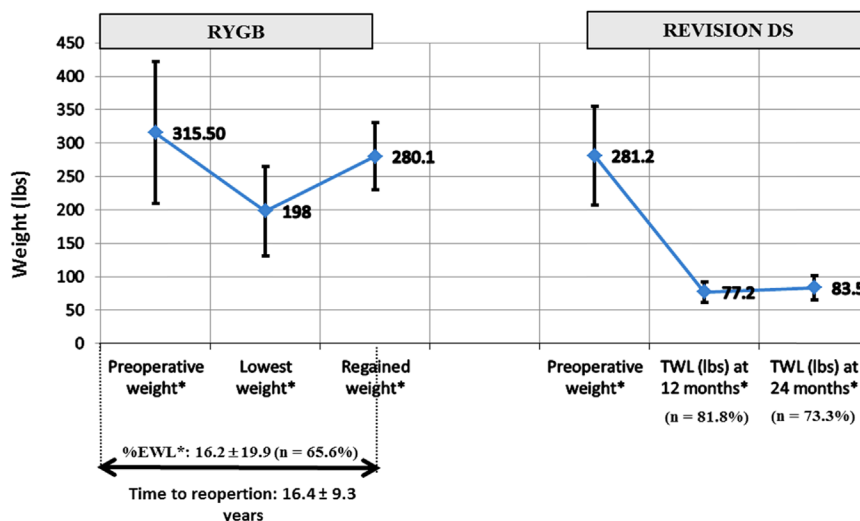


Fig. 2. Graphical representation of weight loss with primary surgery (RYGB) and revision surgery (DS).

levels [8]. Huang et al. [28] present their experience with a patient who had inadequate weight loss and dumping syndrome after RYGB and underwent surgical revision to modified DS with immediate resolution of he dumping syndrome. This proves the essential role that the pylorus plays in the maintenance of consistent blood glucose levels. We believe that with consistent blood sugar levels there will be more satiety. Almost certainly there are additional factors at work, but this forms the core around which we have based our operative selection.

Our study of this population mirrors the only other similar, but much smaller, study reported by Gagner in 2007, wherein 12 patients who failed RYGB were converted to biliopancreatic diversion with DS [13]. In their study, they achieved 63% EWL at 11 months postoperatively, with resolution of all the co-morbidities in their patients. Our study had similar weight loss at 11 months, but we had 2-year follow-up with 56.4% EWL. In this study, the 2-year follow-up is important since the nadir of weight loss after DS is at 18 months statistically; thus, we are reporting the maximum weight loss a revisional DS patient can experience after this surgery. However, a vital

point of this paper is the fact that this procedure has very good weight loss, but it in no way approaches the weight loss seen when SADS or RYDS are done as a primary procedure [29–33].

The reader of our study will notice a few things that make our performance of this procedure unique. The first is our performance of a fundectomy during the surgery. This is done to eliminate most of the receptive relaxation that the stomach experiences after a meal. We also do the surgery loosely over a 40 French bougie. Although that is a small bougie size, we do not come close to the bougie at all. Thus, our gastric remnant volume reduction comes primarily from fundectomy and not the sleeve gastrectomy. Another important technical aspect of the procedure is the preservation of the gastroepiploic perforators to the stomach. Normally, we take these down when doing a DS [15]. However, when performing this procedure, due to the variable lesser curve anatomy and blood supply, we choose to preserve at least 3 perforating vessels rather than trust that the left gastric has not been divided. The reader will also note that we employed 3 techniques when performing the gastrogastrostomy.

Table 5
Weight loss outcomes at 3, 6, 9, 12, 18, and 24 months post–revision DS (RYDS and SADS)

	Value					
	3	6	9	12	18	24
Mo. after revision DS	3	6	9	12	18	24
Patients (n), (%)	25/28, (89.2%)	23/27, (85.1%)	20/24, (83.3%)	18/22, (81.8%)	14/19, (73.6%)	11/15, (73.3%)
%EWL*	31.2 (26, 36.5)	45.1 (40.8, 49.5)	51 (47.4, 54.7)	54.2 (50.3, 57.9)	56 (51.3, 60.7)	56.4 (51.3, 61.5)
%TWL*	15.2 (12.6, 17.7)	22.2 (19.9, 24.5)	25.8 (23.9, 27.6)	27.7 (25.8, 29.5)	28.9 (26.5,31.2)	29.2 (26.6, 31.8)
Change in BMI* (kg/m ²)	7.1 (5.6, 8.6)	10.5 (9.1, 11.9)	12.3 (11.2, 13.4)	13.3 (12.2, 14.4)	14 (12.6, 15.4)	14.2 (12.6, 15.8)
BMI* (Kg/m ²)	42 (40.2, 43.9)	40.1 (38.4, 41.8)	38.3 (36.5, 40)	36.3 (34.3, 38.4)	33 (30.4, 35.9)	29.9 (26.5, 33.4)
%EBMIL*	41 (33.3, 48.6)	58.3 (51.9, 64.8)	66.3 (61, 71.5)	70.2 (64.6,75.7)	72.4 (65.6, 79.2)	72.9 (65.5, 80.2)

BMI = body mass index; DS = duodenal switch; %EBMIL = percent excess BMI lost; %EWL = percent excess weight loss; RYDS = Roux-en-Y reconstruction duodenal switch; SADS = single-anastomosis duodenal switch; %TWL = percent total weight loss

*Values are expressed as means (95% CI).

Although this is important to tell the reader, we do not believe this portion of the procedure has any effect on the long-term weight loss or weight maintenance of the surgery. The performance of this procedure is much easier when it can be done with an EEA technique. However, this is not always possible and any surgeon who undertakes this surgery should be facile at multiple ways of performing gastrogastrotomies.

Another potential limitation of the study relates to the performance of the DS. In 9 patients, we used an RYDS, and in the others we performed an SADS. Despite the fact that they were similar in terms of weight loss, it was easier and less time-consuming to perform the SADS. This analysis must be tempered, as there were very few patients in the RYDS groups to make firm conclusions on differences, especially long-term ones.

Although limited nutritional data was one of the major limitations of our study, it was not intended to answer any realistic concerns post-DS. The mean albumin for our patients ≥ 12 months was 3.6, which is normal. The range for this subset was 1.7–4.6; this includes 3 patients, 2 of which had borderline albumin levels of 3. The other patient had an albumin level of 1.7 because of heart failure that was not related to the surgery. Nutritional data were also not reported in the Gagner paper. However, Torres et al. reported in his series of Spanish SADS patients that his nutritional outcomes using a 250-cm common channel did not differ from his gastric bypass patients [29]. The nutritional outcomes of our 9 patients who had an RYDS were less than those experienced by the Marceau group in Quebec since our Roux limb and common channel are longer [34]. What we can say is that no patient that we were able to contact for this study has experienced protein calorie malnutrition with 300-cm intestinal length.

Lastly, we attempted to be exhaustive in our presentation of complications because the complication rate is so high (25%). Surgeons should be wary of doing this procedure without adequate institutional support. These patients require more of everyone on the team, from the workup to the aftercare.

Conclusion

A laparoscopic revision from RYGB to DS is an effective weight-loss operation with midterm follow-up of 2 years. Complication rate is significant compared with primary procedures. Long-term follow-up is warranted to measure weight recidivism.

Conflicts of Interest

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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