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ORIGINAL CONTRIBUTIONS

Outcomes After Laparoscopic Conversion of Failed Adjustable Gastric Banding (LAGB) to Laparoscopic Sleeve Gastrectomy (LSG) or Single Anastomosis Duodenal Switch (SADS)

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Abstract

Background Inadequate weight loss following LAGB (laparoscopic adjusted gastric banding) requiring band removal and conversion to another bariatric procedure is common. There is a paucity of objective data to guide procedure selection. Single anastomosis modifications (SIPS, SADI, SADS) of the duodenal switch biliopancreatic division (DS-BPD) are being investigated. Laparoscopic sleeve gastrectomy (LSG) has become the most prevalent primary bariatric procedure and has been used for revision following LAGB.

Purpose The purpose is to investigate single-stage LAGB removal to LSG SADS (single anastomosis duodenal switch). A matched cohort analysis compared each revision to a similar patient having a primary procedure. This was performed to understand the impact of prior banding on outcomes with each procedure.

Materials and Methods This is a retrospective study to investigate the outcomes of revision of LAGB for inadequate weight loss to LSG or SADS. To determine whether prior banding impairs results, a matched cohort was done comparing each revision to a patient that had a primary procedure.

Results As expected, patients who had SADS had greater weight loss than LSG. There was no difference in peri-operative and early complications. Both procedures resulted in weight loss. Importantly, with matched cohort, prior LAGB decreased weight loss outcomes in LSG, but not SADS.

Conclusion Conversion of LAGB to LSG or SADS results in weight loss. The presence of LAGB decreases weight loss in LSG, but not in SADS. This can have important implications for long-term outcomes.

Keywords Laparoscopic adjustable gastric banding (LAGB) · Failed/revision LAGB · Single anastomosis duodenal switch · Laparoscopic vertical sleeve gastrectomy · Nutrition · Outcome of revision LAGB

Introduction

As bariatric surgery increases in prevalence and popularity, there is an increasing demand for revision especially for inadequate weight loss or weight regain. However, while there is lack of clarity and diverse opinion for procedure preference for primary operations, there is even less scientific data that proves that revisional bariatric surgery increases life expectancy and what the most beneficial procedures are for revision. In the IFSO Worldwide Survey 2016, revisional procedures made up only 7.4% of bariatric procedures [1, 2]. Duodenal switch with biliopancreatic diversion (DS-BPD) has been shown to be the most effective accepted weight loss procedure for weight loss and diabetes resolution [3]. In contrast, the laparoscopic sleeve gastrectomy (LSG) is now the most popular and commonly performed international bariatric procedure [1, 2, 4]. The number of LSG procedures continues to increase despite increasing reports of weight regain and inadequate weight loss [5]. Thus, the use of LSG as rescue for an already failed weight loss procedure may not be the most effective choice. Alternatively, revision to

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a DS-BPD may be a more effective alternative. Proponents would highlight the probability of successful weight loss. Adversaries would state that DS-BPD is a rarely performed primary bariatric procedure secondary to concerns of micronutrient deficiency and technical complexity.

Single anastomosis duodenal switch (SADS) is becoming increasingly popular to simplify the procedure and expand the amount of bowel available to absorb fat-soluble vitamins. As opposed to a Roux construction requiring a proximal and distal anastomosis, a single anastomosis is performed between the transected duodenum and a loop of small bowel. The net result is that in lieu of an alimentary, biliopancreatic, and common channel limbs, there is an afferent and efferent limb. The SADS referenced in this paper involves a single loop configuration where the small bowel is measured 300 cm proximal to the ileocecal valve and anastomosed to the postpyloric duodenum 3 cm from the pylorus. The stomach is also sleeved in this procedure. There are numerous case series that have demonstrated that these procedures have weight loss at minimum equivalent to Roux-en-Y gastric bypass (RYGB), superior to LSG, and approaching DS-BPD results [6, 7]. However, there are few meaningful reports regarding the role of SADS for revision.

Laparoscopic adjustable gastric banding (LAGB) represented approximately 40% of total bariatric procedures in 2010. With time, there has been increasing patient dissatisfaction and common need for band removal. Unfortunately, following removal weight gain is common [8]. Thus, there is demand to replace the LAGB with an alternative bariatric procedure. There is a paucity of evidence-based material that can assist in defining the best approach. Besides choice of procedure, another controversy is whether these procedures should be done in a single stage or should band removal precede the eventual reconstruction. The purpose of this study is to detail results with single-stage conversion to LSG or SADS, and define whether the presence of prior banding alters weight loss outcomes.

Methodology

This is a retrospective, matched cohort, chart review study to investigate the outcomes of revision of adjustable gastric banding for inadequate weight loss to LSG or SADS.

From January 2013 to March 2016, there were patients who had undergone either LSG or SADS following failed LAGB at Lenox Hill Hospital and Northern Westchester New York, NY. Institutional Review Board of the Northwell Health approval was obtained for this study.

All patients in the analysis underwent an upper gastrointestinal (UGI) series and patients who had esophageal dilation or sigmoid esophagus were not considered for either LSG or SADS. The same surgeon performed the procedures in each institution. Band removal involved full dissection of the band and take down of the plication. The band was left in place until dissection circumferentially was performed. The sleeve gastrectomy was performed using a size 36–40F bougie. SADS was done using a 42F bougie, with a single anastomosis and a 3-m efferent limb measured from the ileocecal valve. Figures 1, 2, 3, and 4 show both of the procedures and highlights the differences. The vertical gastrectomy was oversewn with omentum, and no buttress material utilized for both SADS and LSG. A banana-shaped configuration was utilized to create the tubular gastrectomy with the sleeve gastrectomy starting 3–4 cm from pyloric valve and SADS starting approximately 5 cm from pylorus. By design, the tubular gastrectomy is larger in SADS than LSG. This was not a randomized trial and patients selected their procedure with guidance from the staff based on their post-op expectations and willingness to comply with the extensive micronutrient requirements following SADS. Practice preference was to suggest SADS to higher body mass index (BMI) and diabetic individuals. All patients went through extensive pre- and post-operative nutritional evaluation and education.

Patients were then matched with a control group that underwent primary SADS (101 patients) and primary LSG (417 patients) with one on one matching based on gender, age (± 2), and BMI (± 5).

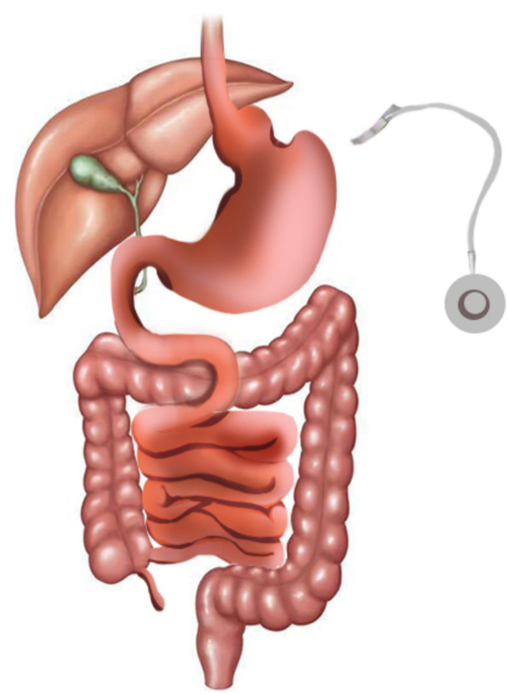

Fig. 1 Removing previous lap band

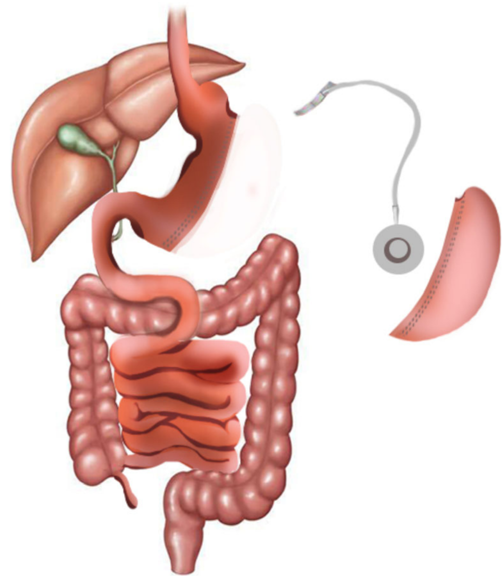

Fig. 2 Creating a sleeve gastrectomy

Matched Cohort Data Collection

The Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) data registry was used to screen all bariatric patients that had undergone LSG and SADS from January 2013 to March 2016. All data were further collected from Allscript and Mysis database from Northwell Health system. All data was protected by REDCap and encrypted. The eligible population consisted of all patients meeting the 1991 National Institutes of Health Consensus Conference guidelines for bariatric surgery, with a BMI ≥ 40 kg/m^2 or a BMI ≥ 35 kg/m^2 with associated comorbidities and had history of LAGB surgery, with band in place. UGI was obtained

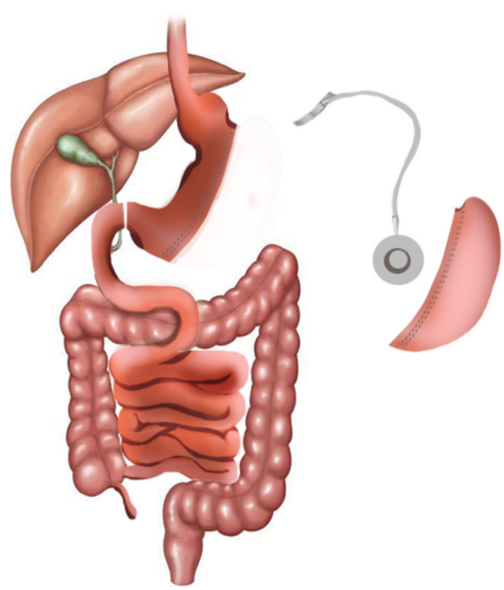

Fig. 3 Transect the first part of duodenum post pylorus sphincter

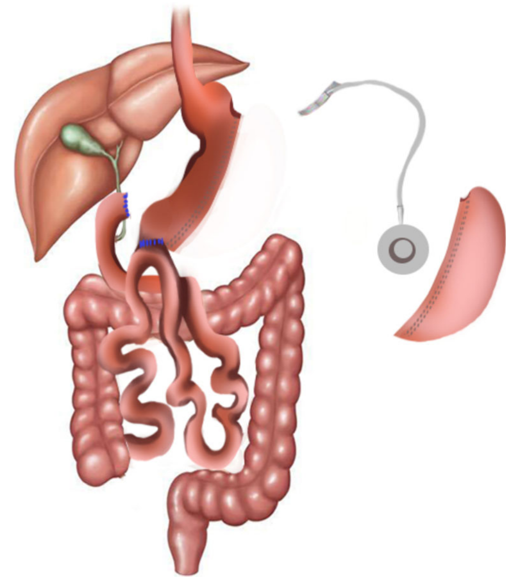

Fig. 4 Creating a modified duodenal switch by bringing 300-cm intestine from the ileocecal valve and anastomose it with the previous transected site of duodenum

to make sure that there was no esophageal dilation, or severe motility disturbance. Data collected was then divided into two types of procedure, SG and SADS. The follow-up data were divided into 0–3 month, 4–6 month, 7–12 month, and more than 12 month post-operation. The following variables were retrieved from the mentioned database: age, gender, height, weight, body mass index (BMI), comorbidities (diabetes, hypertension, gastroesophageal reflux GERD, obstructive sleep apnea (OSA), hyperlipidemia), date of surgery, excess body weight (EBW), ideal body weight (IDW) based off of BMI of 25, glucose level, albumin level, vitamin D, and lipid profile. We also collected any readmission, reoperation, and adverse events that occurred after the surgery.

Statistical Methods

Descriptive statistics were used to summarize patient sociodemographic (comorbidities and adverse events). Means, standard deviations, and medians were calculated for continuous variables; frequency distributions were generated for categorical variables. Comparative between-group analysis of continuous, normal distribution data (weight loss (WL), excess body weight loss% (EWL%), BMI unit loss (BMIL), excess BMI loss% (EBMIL%)) was performed using paired Student's *t* test for matched cohort and independent *t* test to compare LAGB-SADS and LAGB-LSG groups. Pearson correlation coefficient was used to determine the relationship between duration after surgery and weight loss (EWL% and EBMIL%). IBM SPSS statistic version 22 was used for statistical analysis.

Results

Pre-operative Demographic Data

A total of 9 males and 31 females underwent LAGB-LSG and 8 males and 12 females underwent LAGB-SADS. The mean age for SG group was 45 years old (SD = 13) and the mean age for SADS group was 42 (SD = 10). The mean BMI and excess body weight (EBW) in the SADS group were higher than in LSG (mean BMI SADS = 47.6, BMI LSG = 44.9) (mean EBW SADS = 160, mean EBW LSG = 143). The incidence of hyperlipidemia in SADS group was significantly higher (SADS = 33.3%, LSG 6.9%; $p = 0.044$), (Table 1).

Matched Cohort Results

A paired sample t test was conducted to compare conversion procedures of LAGB to SADS and vertical sleeve gastrectomy (LSG) matched with primary procedure (SADS and LSG). There was no significant difference in the EWL%, and EBMIL% for revision SADS and primary SADS in all visits ($p > 0.05$). There were significant differences seen revision LSG and primary LSG in EWL%, and BMIL at 0–12 months (Table 3).

Post-operative Results

For LABG-SADS, there were 20 patients who followed up at 0–3 months, 19 at 4–6 months, 14 at 7–12 months, and 18 at greater than 12 months. For LABG to LSG, there were 38 patients who followed up 0–3 months, 30 at 4–6 months, 13 at 7–12 months, and 15 at greater than 12 months. At 0–3 months, EBWL was 26.5% for LABG-SADS and 16.5% for LAGB-LSG. At 4–6 months, EBWL was 50.2% for LABG-SADS, and 31.7%. At 7–12 months, EBWL was 57.2% for LABG-SADS and 44.1% for LABG-LSG. At > 12 months, EBWL was 70.6% for LABG-SADS and 67.7% for LABG-LSG. As in Table 2, there was no difference in EBWL between LAGB-SADS and primary SADS. As in Table 3, LABG-LSG had significantly lower EBWL than primary LSG in under 12 months, and over 12 months there was no statistical difference. EWL% in LAGB-SADS was significantly greater than LAGB-LSG post-operatively for the first 1 year ($p < 0.05$) (Table 4). We defined "adequate weight loss" as percent of EWL, of at least 50%. At their final appointment, both SADS patients and LSG patients had adequate weight loss at > 12 month (79% for SADS and 67.8% for LSG).

Correlation Between Duration and Weight Loss (EWL% and EBMIL%), After Surgery for LAGB-SADS vs LAGB-LSG

There is a strong correlation between the duration after surgery and weight loss in both groups (EWL% = 0.662 and EBMIL% = 0.645 for LAGB-SADS and EWL% = 0.542 and EBMIL% = 0.492 for LAGB-SG group) with $r = 0.00$ (Table 5).

Nutritional Outcome in LAGB-SADS

As specific concern has been raised for nutrition following malabsorptive procedures, and SADS specifically, we have

Table 1 Pre-operative demographic data

Variable	LAGB-SG (n = 40)	LAGB-MDS (n = 20)	p value
Gender, n (%)			
Male	9 (22.5)	8 (42.1)	
Female	31 (77.5)	11 (57.9)	
Age, mean (SD)	44.9 (13)	42.3 (10)	NS
Weight (kg), mean (SD)	143.4 (20)	124.5 (25.9)	NS
BMI, mean (SD)	47.7 (7.3)	44.7 (8)	NS
EBW	65.2 (23.3)	72.8 (19.5)	NS
IBW	59.5 (19.7)	61.3 (10.5)	NS
Comorbidities			
T2DM, n (%)	7 (24.1)	1 (5.5)	NS
Hypertension, n (%)	10 (34.5)	9 (50)	NS
GERD, n (%)	7 (24.1)	6 (33.3)	NS
OSA, n (%)	2 (7)	5 (27.7)	NS
Hyperlipidemia, n (%)	2 (6.9)	6 (33.3)	0.044

LAGB-SG laparoscopic adjustable gastric banding–sleeve gastrectomy, *LAGB-SADS* laparoscopic adjustable gastric banding–single anastomosis duodenal switch, *BMI* body mass index, *EBW* excess body weight, *IBW* ideal body weight, *T2DM* type 2 diabetes mellitus, *GERD* gastroesophageal reflux disease, *OSA* obstructive sleep apnea, *NS* non-significant

Table 2 Matched cohort LAGB-SADS and primary SADS

Matching criteria	LAGB-SADS	Primary SADS	*p* value
Gender			
Male (*n*)	8	8	–
Female (*n*)	12	12	
Age ± 5 (mean)	42 (SD = 10)	42 (SD = 10)	–
BMI ± 5 (mean)	45.8 (SD = 6.8)	46 (SD = 6.01)	–
Results			
Visit 1 (0–3 months) 20 patients			$p > 0.05$
EBWL% (mean, SD)	26.5 (SD = 15.5)	21.8 (SD = 12.3)	
EBMIL% (mean, SD)	31.1 (SD = 16.7)	27.7 (SD = 3.7)	
Visit 2 (4–6 months) 19 patients			$p > 0.05$
EBWL% (*n*/mean, SD)	50.2 (SD = 18.6)	64 (SD = 19)	
EBMIL% (*n*/mean, SD)	57.9 (SD = 19.4)	53.2 (SD = 27)	
Visit 3 (6–12 months) 14 patients			$p > 0.05$
EBWL% (*n*/mean, SD)	57.2 (SD = 10.3)	68 (SD = 29)	
EBMIL% (*n*/mean, SD)	66.7 (SD = 12.1)	85 (SD = 29.6)	
Visit 4 (> 12 months) 18 patients			$p > 0.05$
EBWL% (*n*/mean, SD)	70.6 (SD = 13.8)	83.2 (SD = 28)	
EBMIL% (*n*/mean, SD)	80 (SD = 13.9)	86.6 (SD = 19)	

EBWL% excess body weight loss percentage, *EBMIL%* excess body mass index loss percentage, *SD* standard deviation, *LAGB* laparoscopic adjustable gastric banding, *SADS* single anastomosis duodenal switch

included the nutritional data for the conversion of LAGB to SADS patients. For LAGB-SADS, improvement is seen in HBA1C (6.0 to 5.4%), total cholesterol (208 to 136.4 mg/dL), HDL (58.2 to 63 mg/dL), LDL (116.7 to 57.8 mg/dL), and triglyceride (161.7 to 77.4 mg/dL).

Iron, vitamin A, vitamin B1, and vitamin D levels improved from pre-operation to post-operation more than 12 months; however, this analysis is significantly limited by a very small cohort of patients as well as patient follow-up (Table 6).

Table 3 Matched cohort LAGB-LSG to primary LSG

Matching criteria	LAGB-LSG	Primary LSG	*p* value
Gender			
Male (*n*)	9	9	–
Female (*n*)	31	31	
Age ± 5 (mean)	44.9 (SD = 12.9)	45 (SD = 13)	–
BMI ± 5 (mean)	44 (SD = 7.2)	44 (SD = 4.5)	–
Results			
Visit 1 (0–3 months) 38 patients			0.04
EBWL% (mean, SD)	16.5 (SD = 7.8)	22.1 (SD = 10.2)	
EBMIL% (mean, SD)	21.9 (SD = 14.2)	22.4 (SD = 9.1)	
Visit 2 (4–6 months) 30 patients			0.00
EBWL% (mean, SD)	31.7 (SD = 10.8)	41.1 (SD = 14.8)	
EBMIL% (mean, SD)	39.7 (SD = 16.5)	42.4 (SD = 16)	
Visit 3 (7–12 months) 13 patients			0.02
EBWL% (mean, SD)	44.1 (SD = 17.6)	65.7 (SD = 19.3)	
EBMIL% (mean, SD)	51.5 (SD = 20.9)	77.2 (SD = 20)	
Visit4 (> 12 months) 15 patients			> 0.05
EBWL% (mean/SD)	67.7 (SD = 13.9)	67.7 (SD = 16.8)	
EBMIL% (mean/SD)	67.8 (SD = 23)	73.4 (SD = 21)	

EBWL excess body weight loss percentage, *EBMIL* excess body mass index loss percentage, *SD* standard deviation, *LAGB* laparoscopic adjustable gastric banding, *SG* sleeve gastrectomy

Table 4 Laparoscopic adjustable gastric banding to modified duodenal switch (MDS) and vertical sleeve gastrectomy results (SG)

	ID	*N*	Mean	*p* value
EBWL (0–3 months)	MDS	17	26.5 (SD = 15.5)	0.02
	SG	38	16.5 (SD = 7.8)	
EBMIL (0–3 months)	MDS	17	31.1 (SD = 16.7)	0.04
	SG	38	21.9 (SD = 14.2)	
EBWL (4–6 months)	MDS	17	50.2 (SD = 18.6)	0.00
	SG	30	31.7 (SD = 10.8)	
EBMIL (4–6 months)	MDS	17	57.9 (SD = 19.4)	0.03
	SG	30	39.7 (SD = 16.5)	
EBWL (7–12 months)	MDS	15	57.2 (SD = 10.2)	0.023
	SG	13	44.1 (SD = 17.6)	
EBMIL (7–12 months)	MDS	15	66.7 (SD = 12.1)	0.025
	SG	13	51.5 (SD = 20.9)	
EBWL (> 12 months)	MDS	5	70.6 (SD = 13.8)	> 0.05
	SG	15	67.7 (SD = 55)	
EBMIL (> 12 months)	MDS	5	79.1 (SD = 13.9)	> 0.05
	SG	15	67.8 (SD = 23.0)	

Weight loss outcome in failed LAGB-MDS versus LAGB-SG

EBWL excess body weight loss, *EBMIL* excess body mass index loss. *LAGB* laparoscopic adjustable gastric banding, *MDS* modified duodenal switch, *SG* sleeve gastrectomy

Results on Adverse Events

The LAGB-SADS group had two patients with serious adverse events: incarcerated hernia and bowel perforation adjacent to anastomosis, while the LAGB-SG group also had two patients with adverse events: pulmonary embolus and anemia (Table 7). The bowel perforation was in a patient that three previous operations including an open cholecystectomy which compromised duodenal dissection. This patient required laparotomy on POD #1. The incarcerated hernia remarkably was at an old trocar site that was not used for the revision. There were no leaks or strictures related to the single-stage approach.

Table 5 Correlation between duration and weight loss (EBWL% and EBMIL%) after surgery for LAGB-MDS vs LAGB-VSG

		EBWL	EBMIL
LAGB to SADS			
Months	Pearson correlation	0.662**	0.645**
	Sig. (2-tailed)	0.000	0.000
	N	50	50
LAGB to LSG			
Months	Pearson correlation	0.542**	0.492**
	Sig. (2-tailed)	0.000	0.000
	N	89	89

**Correlation is significant at the 0.01 level (2-tailed)

Discussion

An increasing issue confronting bariatric surgeons is the surgical management of the failed LAGB [8]. Removal without conversion is associated with increased weight gain [9]. The purpose of this analysis is to report our results with single-stage band removal to either LSG or SADS (single anastomosis duodenal switch). Certainly, there are several other surgical options that were not studied. These include conversion to RYGB, single anastomosis gastric bypass, or conventional DS. Therefore, while there are many interesting points that our data has generated, the question of the optimal procedure still will remain an area of conjecture.

It is important to realize that all patients included in this study had a pre-operative upper GI series to exclude patients with esophageal dilation or advanced motility disturbances secondary to LAGB. Our practice preference for patients with dilation is either band removal and reinvestigation, or single-stage conversion to RYGB. Our concern is that patients with motility issues will not tolerate the high pressure secondary to longitudinal gastrectomy. Our data demonstrates that in the 60 patients that met these criteria, we were able to do band removal and longitudinal gastrectomy without stricture or leak. Many advocate that for optimal results, the band should be removed prior to definitive conversion. In our experience, we have found that the single-stage approach has advantages and does not compromise either short- or long-term outcomes. In this case, patients have only a single procedure. Leaving the band in place until fully dissected can help reveal the appropriate planes for dissection. Although, our results demonstrate that this is an effective practice pattern in our hands, there is no data reported that should make surgeons alter their practice preference. If a surgeon feels more comfortable with staging, the results of our case series should not alter practice preference. However, with proper experience, patient selection, and technique, single-stage conversion is practical and acceptable.

Carr et al. conducted a retrospective review comparing results for converting failed LAGB (89 patients) to LSG versus LRYGB and found no difference in complication rates, hospital stay and early weight loss, however found that a staged approach was often needed especially for LSG [10]. Biliopancreatic diversion with duodenal switch (BPD/DS) combines restrictive and malabsorptive elements to result in (> 70%) weight loss and significant decrease in obesity-related comorbidities (> 80%) [11]). In addition, the recidivism rate of BPD/DS has been low with EWL of 73% at mean follow-up of 7.3 years in a study by Marceau et al. [11]). Poych et al. conducted a prospective study analyzing the conversion of 35 patients from LAGB failure to BPD/DS and found EWL of 55% after LAGB conversion to BPD/DS and 48% for BPD/DS alone at 3 years as well as a reduction in obesity-related comorbidities [12].

Table 6 Nutritional outcome in LAGB-MDS

	Pre-op Mean (SD) (*N*)	0–5 months *N* = 19 Mean (SD) (*N*)	5–11 months *N* = 11 Mean (SD) (*N*)	> 12 months *N* = 6 Mean (SD) (*N*)
Glucose (mg/dL)	98.0 (35) (20/20)	89.0 (15.7), (19/19)	86.1 (9.8), (11/11)	93.0 (6.24), (6/6)
HBA1C (%)	6.0 (0.9) (16/20)	5.6 (0.8), (19/19)	5.42 (0.54) (11/11)	5.4 (0.2), (6/6)
TChol (mg/dL)	208.0 (45.6) (13/20)	154.5 (29.7), (19/19)	158.5 (33.9) (11/11)	136.4 (23.6), (6/6)
HDL (mg/dL)	58.2 (16.7) (12/20)	43.6 (12.6), (19/19)	47.8 (15.1) (11/11)	63 (24.1), (6/6)
LDL (mg/dL)	116.8 (46.6) (12/20)	91.5 (30.2), (19/19)	88.0 (36.9) (11/11)	57.8 (23), (6/6)
Triglyceride (mg/dL)	161.7 (77), (13/20)	97.8 (25.7), (19/19)	93.0 (31.0) (11/11)	77.4 (14.7), (6/6)
Albumin (g/dL)	4.3 (0.3), (18/20)	4.06 (0.46), (19/19)	3.9 (0.57) (11/11)	4.1 (0.27), (6/6)
Iron (μg/dL)	29.2 (14.2), (9/20)	78.0 (54.5), (19/19)	53.0 (24.7) (11/11)	68.7 (26.1), (6/6)
Hematocrit	38.7 (4.6), (9/20)	38.9 (5), (19/19)	38.7 (4.6) (11/11)	40.2 (2.7), (6/6)
Hemoglobin	12.6 (1.9), (9/20)	12.5 (1.9), (19/19)	12.6 (1.8) (11/11)	12.8 (1), (6/6)
Vitamin A (μg/dL)	N/A	30.6 (7.5), (8/19)	39.8 (33.2) (8/11)	50.6 (12.9), (6/6)
Vitamin B1 (nmol/L)	N/A	120.5 (2.12), (8/19)	77.3 (46.1) (8/11)	144.3 (36), (6/6)
Vitamin B12 (pg/mL)	N/A	722.33 (83.4), (8/19)	811.6 (336) (8/11)	645.25 (320), (6/6)
Vitamin D (ng/mL)	29.2 (14.2), (8/20)	26.8 (12), (8/19)	29.35 (15.2) (8/11)	38.2 (24.6), (6/6)

LAGB-MDS laparoscopic adjustable gastric banding to modified duodenal switch, *HBA1c* hemoglobin A1c, *TCHOL* total cholesterol, *HDL* high-density lipoprotein, *LDL* low-density lipoprotein, *N/A* not available, *N* number of patients, *SD* standard deviation

Our paper is the first to compare LSG to SADS. The major difference between the two procedures is that instead of food traveling the entire length of the intestine in SG, only 3 m is used in SADS. As there is no Roux or alimentary limb, the amount of variables is reduced and comparison allows us to determine the degree of weight loss and impact of the stomach components and intestinal aspects of the procedure. At most points in the analysis, there is about a 20% increase in weight loss secondary to adding the intestine. To further understand the relative contribution and importance, we performed a matched cohort analysis. We matched each revision patient to the closest patient in our data base with a primary procedure. We found that prior band placement compromised outcomes in LSG but did not in SADS.

It is our belief that the impact of prior banding on LSG outcomes is a most important and significant finding. The fact that weight loss is higher in SADS than LSG is certainly an expected finding. In contrast to LSG, the negative impact of prior banding is non-existant in SADS. As increasing concern is being voiced about long-term results in primary, it is logical to believe that this will be magnified in a subgroup that has already failed a bariatric procedure and has a sleeve created following prior banding. In contrast, SADS combines gastric and intestinal mechanisms for weight loss. As a result, it is less dependent on the gastric portion and thus reasonable that outcomes are less affected by prior LAGB surgery.

Table 7 Adverse events

	SG (*n* = 40)	MDS (*n* = 20)
Adverse events, *n* (%)	2 (6.9) -Anemia -Pulmonary embolus	2 (11.1) -Incarcerated hernia -Bowel perforation
Readmission, *n*	Nil	2
Reoperation, *n*	Nil	2

SG vertical sleeve gastrectomy, *MDS* modified duodenal switch

Therefore, our data demonstrates that both procedures provide meaningful 1-year weight loss and can be performed in a single stage. The fact that outcomes are not compromised in SADS by prior banding make us believe that weight loss will be superior and that weight regain will be reduced, as opposed to LSG. However, many still have concern about the technical complexity and potential nutritional abnormalities. In our series, there were two major adverse outcomes in the SADS group. On POD #1, a patient developed an acute abdomen that required re-exploration. The patient had a previous open cholecystectomy and a bowel injury was found adjacent to the anastomosis. The second patient presented with an incarcerated hernia in a trocar site from a previous operation. There was only a single adverse serious outcome in the LSG subgroup. A patient presented with a PE and required anticoagulation. Nutritional data is provided for our SADS patients. While not complete, it does reveal that at 12 months, there was an increase in Fe and vitamin D levels.

While there is interesting information to be obtained by this case series and matched cohort, there are significant limitations. The patients selected their procedure based on counseling. This allocation bias restricts statistical analysis. Additionally, there is great disparity in patients that require revision. They have surgery at different points and the impact that their band had on their anatomy is also not uniform.

Follow-up is not always regular and data limited by the natural obstacles that occur in clinical medicine. Additionally, there is no comparison to other procedures, most significantly RYGB. As a result, this paper cannot demonstrate superiority for any single approach or procedure. However, it does reveal that single-stage conversion to LSG or SADS is practical and effective. Perhaps, most importantly, prior banding does not compromise results for SADS. We believe that this be a harbinger of things to come. As prior banding compromises weight loss for LSG, we predict that long-term weight loss will be less than optimal in many patients. Adding the intestine as is done in SADS mitigates the negative impact of the band. With time, we anticipate that this difference will become more noticeable and a greater number of patients will require operations that incorporate the intestinal bypass to maintain adequate weight loss.

Conclusion

Although both LSG and SADS resulted in significant weight loss following LAGB, SADS had significantly higher weight loss in terms of %EBWL and BMI unit loss. This is not surprising as SADS is also a malabsorptive intervention, inducing greater EWL. We believe that with lower rates of recidivism in SADS patients, long-term follow-up will continue to show better long-term outcomes as far as maintaining weight loss in the SADS arm. As our practice is mostly a LSG and SADS practice, we will continue to offer both of these revision procedures, employing the SADS revision especially for patients with significant obesity-associated comorbidities or those requiring higher rates of weight loss SADS is our procedure of choice for failed LAGB; however, it is not possible in all patients (such as those with extensive adhesions or those patients that do not desire a more involved procedure such as MDS).

Compliance with Ethical Standards

Institutional Review Board of the Northwell Health approval was obtained for this study.

Conflict of Interest The authors declare that they have no conflict of interest.

Formal Consent For this type of study, formal consent is not required.

Informed Consent Informed consent statement does not apply for this study.

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