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Original article

Single-anastomosis duodenoileal bypass as a second step after sleeve gastrectomy

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Abstract

Background: After sleeve gastrectomy, many surgical options are available in patients with insufficient weight loss. Duodenal switch is typically considered the operation that results in higher weight loss, although it is, perhaps unjustly, considered technically difficult and may be accompanied by severe side effects. Single-anastomosis duodenoileal bypass with sleeve gastrectomy is a simplification of the duodenal switch that may behave as a standard biliopancreatic diversion but is easier and quicker to perform. Given its effectiveness as a primary surgery we hypothesized that it would be successful as a second-step operation. The objective of this study was to analyze the weight loss and co-morbidities resolution after a single-anastomosis duodenoileal bypass (SADI) performed as a second step after sleeve gastrectomy.

Methods: Sixteen patients with an initial body mass index of 56.4 kg/m^2 and a mean excess weight loss of 39.5% after a sleeve gastrectomy were submitted to a single-anastomosis duodenoileal bypass with a 250-cm common channel.

Results: There were no postoperative complications. The mean excess weight loss was 72% 2 years after the second-step surgery. The complete remission rate was 88% for diabetes, 60% for hypertension, and 40% for dyslipidemia. The mean number of daily bowel movements was 2.1. One patient suffered an isolated episode of clinical hypoalbuminemia.

Conclusion: SADI is a safe operation that offers a satisfactory weight loss for patients subjected to a previous sleeve gastrectomy. The side effects are well tolerated, and complications are minimal. (Surg Obes Relat Dis 2014;▮:00–00.)

Keywords: Duodenoileal bypass; Sleeve gastrectomy; Staged surgery; Weight loss

Sleeve gastrectomy (SG) is a highly effective stand-alone surgical procedure for many morbidly obese patients and an adequate operation as a first step for super-obese (SO) patients or high-risk patients [1,2]. If weight loss after SG is inadequate, or if there is weight regain, different surgical options are available as a second step: resleeve, sleeve plication, banding of the sleeve, gastric bypass (GB), or duodenal switch (BPD-DS) [2].

For insufficient weight loss in a patient with a correct sleeve anatomy, we usually choose a malabsorptive procedure, especially if the patient was initially SO, as it offers the best weight loss for this subset of patients [3]. Five years ago, we introduced the single-anastomosis duodenoileal bypass with sleeve gastrectomy (SADI-S), a modified and

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simplified DS that has demonstrated satisfactory short- and long-term results [4]. After this success, we decided to introduce single-anastomosis duodenoileal bypass (SADI) as a second step after SG for insufficient weight loss. This study was approved by the Hospital Ethical Committee. The study is registered in ClinicalTrials.gov (NCT01685177).

Methods

From September 2009 to December 2012, 16 patients, 12 female and 4 male, subjected to an initial SG were selected for SADI as a second-step operation. In this period, 124 patients had been subjected to SG in our department, 46 programmed as a first step, 75 as a stand-alone procedure, and in 3 cases the SG was an intraoperative decision for technical difficulties. Twenty-nine patients (23%) have been submitted to a second step.

Attending to the SADI population, the mean age at the time of the sleeve operation was 42 years (18–62), the mean initial weight was 147 kg (99–216), the mean body mass index (BMI) was 56.4 kg/m^2 (41–71.5), and the mean excess weight was 82 kg (39–140). Nine patients (56%) were diabetics, 2 of whom were on insulin therapy; 10 patients (62%) had hypertension; and 10 (62%) had dyslipidemia. No intra- or postoperative complications presented after the SG. Patients were followed in a multidisciplinary basis every 3 months. A second step was offered if $<50\%$ excess weight loss was achieved, if the patient began to regain the weight after reaching an adequate weight nadir, and to every SO patient regardless of satisfactory weight loss after the 18th postoperative month. SADI was performed as a second step in all patients without problems derived from the SG, which could indicate dismantling of the sleeve (severe gastro-esophageal reflux), and without any accompanying conditions contraindicating a malabsorptive operation, such as liver cirrhosis or inflammatory bowel disease.

The mean time for the second-step operation was 24 months (16–38) after the initial operation, the mean excess weight loss (EWL) at the time of the reoperation was 39.5% and the mean BMI was 44 kg/m^2 (35.5–55.8). Four patients had achieved a EWL $>50\%$. Five patients out of 9 had remission of their diabetes after the SG, 4/10 had remission of hypertension, and 6/10 had remission of dyslipidemia.

Technique

The first operation was a standard SG performed over a 42–54 French gastric bougie. For SADI, patients were placed in the supine position with legs closed and the surgeon standing at the left-hand side of the patient.

After a complete evaluation of the abdomen, the distal end of the previous sleeve was identified, and with the stomach held upwards, dissection of the greater curvature was completed through the first segment of the duodenum, 2- or 3-cm distal to the pylorus. The posterior wall of the duodenum was separated from the pancreas down to the pancreatoduodenal groove and the gastroduodenal artery. After opening the peritoneum at the right margin of the duodenum with care not to damage the right gastric artery, the duodenum was encircled and divided with a 60-mm blue cartridge linear stapler. The ileocecal junction was located, and 250 cm was measured proximally at 10-cm intervals. The selected ileal loop was ascended antecolically and isoperistaltically anastomosed to the proximal duodenal stump with a 30-mm linear stapler and closure of the defect with a 2-layer suture [5] or with a 2-layer running suture hand-sewn anastomosis. The anastomosis was always covered with a TachoSil sponge (Takeda Pharmaceuticals, Zurich, Switzerland), and a vacuum drain was left behind.

Results

No intra- or postoperative complications were registered. The mean operative time was 114 minutes (45–160), and the mean postoperative hospital stay was 5 days (3–7). After discharge, all patients were maintained on a hypocaloric diet for 3 to 4 weeks, after which the patients were progressively introduced to a solid diet. Iron (100 mg daily), calcium (calcium citrate, 1200–2000 mg daily), and a multivitamin complex were also prescribed initially to all patients and were continued or discontinued based upon the analytical and clinical results. When necessary, vitamin D3, 10,000–30,000 IU/wk was also administrated.

All patients were evaluated at 3-month intervals from the operation. The mean follow-up time was 21 months (2–46). The mean EWL had been 39.5% at the time of the second-step operation and became 62.5% (43–80) at 6 months after the reoperation, 68.6% (49–83) after 12 months, 73% (57–87) after 18 months, and 72% (62.6–81.6) 2 years after the SADI (Fig. 1). The mean BMI was 35 kg/m^2 at 2 years after the revisional surgery (31.6–37) (Fig. 2).

In 8 patients (88.8%), a complete remission of diabetes was achieved, with all patients exhibiting values in the normal ranges of glycemia and glycated hemoglobin, and only 1 patient continuing treatment with 1 daily dose of metformin. Hypertension remitted in 60% of the cases, improved in 30%, and remained unchanged in 1 case. Dyslipidemia improved in all cases, with absolute normalization of all parameters in 40% of the cases.

The mean number of daily bowel movements was 2.1 (0–5), with only 2 patients reporting >3.

One patient had to be admitted in the first postoperative year for clinical hypoalbuminemia, which did not recur over the next 2 years. The analytical data after SG and in the second postoperative year after SADI are presented in Table 1. Table 2 summarizes oral supplements taken by the patients before and after SADI.

Up to now, no patient has presented signs of intestinal obstruction and no patient has been reoperated for an internal hernia.

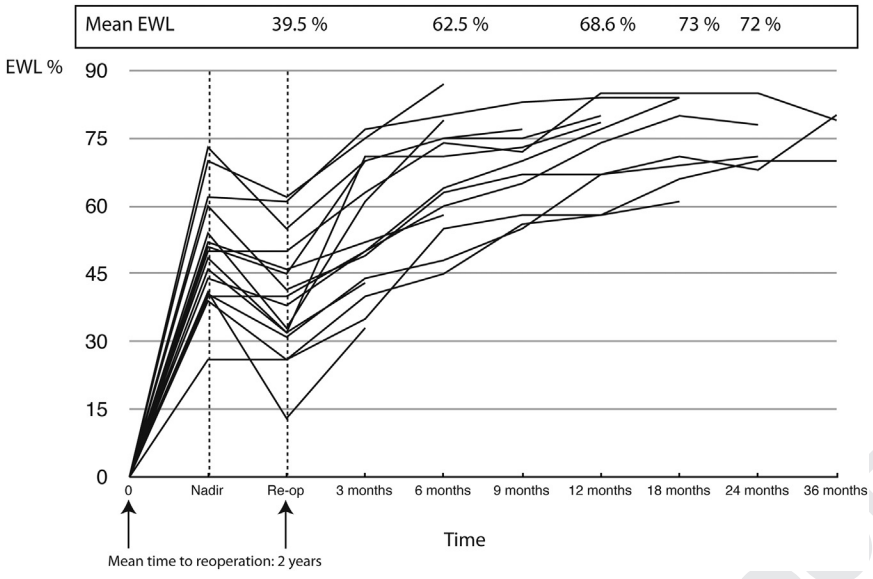

Fig. 1. The excess weight loss (EWL) percentage of the entire series with the sleeve procedure, the nadir reached after the sleeve procedure, and the progression of the EWL percentage after the second step operation. Means are expressed in the upper box.

Discussion

The present work reports our initial experience with SADI, a one-loop duodenal switch with a 250-cm common limb, as a second step for patients with a previous sleeve gastrectomy. Our results demonstrate good definitive weight loss after the second procedure, increasing from an initial 39.5% EWL after the sleeve procedure to a final 72% EWL after the duodenal bypass, with all patients losing $>50\%$ of their initial excess weight. This number is of particular importance because the initial mean BMI of the present series was over 56 kg/m^2, and 75% of the patients were initially SO patients. Co-morbidities were successfully controlled after the second operation.

SADI-S is a simplified BPD-DS, and since we introduced it in 2007, SADI-S seems to achieve similar results as the original BPD-DS [6]. Current measurement of the efferent loop is 250 cm, which is similar to the alimentary limb of BPD-DS [4]. The unification of the alimentary and the common limb in a single loop apparently has no negative effect on weight loss, and the reduction to 1 anastomosis saves operative time and reduces the probability of post-operative complications. These principles were applied to introduce SADI as a second step after a failed SG.

It is a matter of controversy which operation should be performed as a second step after an SG. Many different techniques are available. It is possible to repeat the SG if any part of the stomach is dilated, as first proposed by

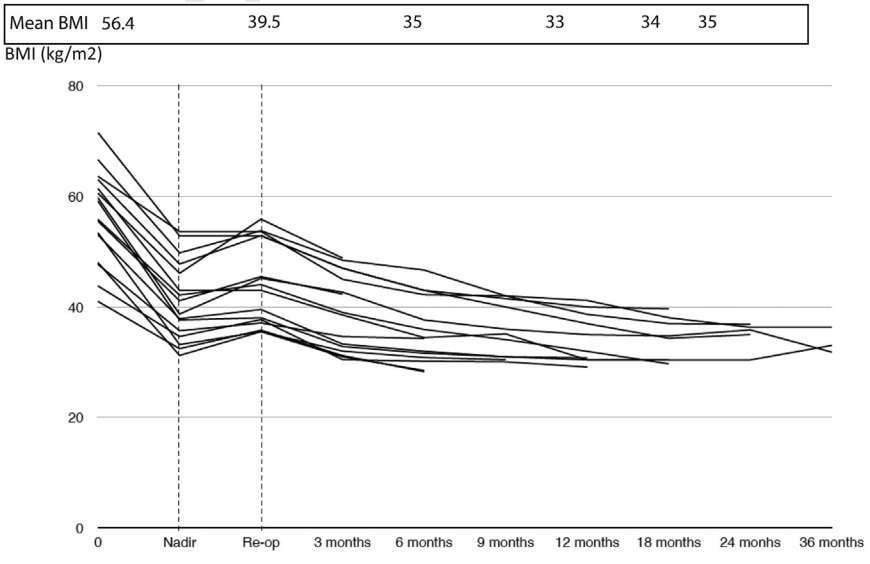

Fig. 2. Body mass index evolution of the entire series before and after the second-step operation. Means are expressed in the upper box.

Table 1
Nutritional values after sleeve and after single-anastomosis duodenoileal bypass

	Postsleeve			Post-SADI		
	Mean (SD)	Range	% Abnormal	Mean (SD)	Range	% Abnormal
Iron (μg/mL)	78.7 (33.0)	42–156	0	66.5 (26.1)	30–104	50
Vitamin B12 (pg/mL)	357 (126)	158–554	6	414.5 (295.6)	172–1294	6
Folic acid (ng/mL)	6.5 (5.06)	2.03–20.3	12	6.0 (2.9)	2.0–11.3	6
Vitamin D (ng/mL)	23.1 (15.1)	9.7–59.8	Deficiency 6 Insufficiency 50	17.2 (12.7)	3.9–53.7	Deficiency 6 Insufficiency 50
Parathormone (pg/mL)	69.4 (31.8)	16.6–113	25	72.4 (38.1)	28.9–155	25
Albumin (g/dL)	4.1 (0.2)	3.6–4.5	0	4 (.2)	3.7–4.3	0
Proteins (g/dL)	7.1 (0.4)	6.3–7.7	6	6.7 (.3)	6.2–7.4	18
Copper (μg/mL)	125.8 (13.2)	109–146	0	95.4 (20.6)	59–124	12
Selenium (μg/mL)	79.3 (7.9)	109–146	0	60.6 (18.1)	35–96	50
Zinc (μg/mL)	84 (9.5)	65–95	0	67.9 (11.9)	54–88	31
Vitamin A (mg/L)	.4 (0.1)	.3–.5	0	.3 (.1)	.2–.6	25
Vitamin E (mg/L)	12.9 (2.3)	10.7–16	0	9.6 (2.5)	6.2–15	0

SADI = single-anastomosis duodenoileal bypass; SD = standard deviation.

Gagner and Rogula [7] for insufficient weight loss after a BPD-DS and later by Baltasar et al. [8] as a revisional operation for a failed SG. Plication or banding of the sleeve are other possibilities that try to reduce complications associated with the procedure, and GB is likely the most used surgical option [9–11]. However, there are few papers reporting the results of GB performed as a second step; it may be that the results are similar to those obtained after GB was performed as an initial operation. Gautier et al. [11] reported 61.7% EWL at 15 months after the second step, whereas Alexandrou et al. [10] reported a 71.9% long-term EWL for a series of SO patients with an initial mean BMI of 59 kg/m^2 and a final BMI of 33.6 kg/m^2. In our opinion, these results are very positive and quite similar to those obtained by our group. Other groups report more discrete results after converting SG into GB and even note that patients who regain weight after SG could be regain weight after GB [12]. BPD-DS was the initial option for a second step after SG, as SG was born as the staging of BPD-DS. BPD-DS has also been the recommendation of many surgeons because most of the patients completing the second stage after SG had initially been SO patients, and BPD-DS and BPD-like operations exhibit better long-term results in this subset. Sovik et al. [13] observed a 26% failure rate after GB versus a 0% after BPD-DS, and Prachand et al. [3] reported a 40% failure rate after GB in SO patients and a 16% failure rate after BPD-DS. Nonetheless, the secondary effects associated with BPD and BPD-DS may sometimes, in some authors' opinions, outweigh the beneficial weight loss of malabsorptive surgery [13,14]. Problems secondary to malabsorptive surgery have likely been exaggerated, as when exhaustive comparisons between GB and BPD-DS are performed, significant differences are only observed in serum calcium levels and bowel movements [15]. In our series, decreased levels of vitamin D, iron, and some micronutrients (selenium and zinc) were detected, but these abnormalities were not severe and have also been reported after standard GB [16,17]. On the other hand, the rates of co-morbidities resolution, especially type 2 diabetes mellitus, were more than satisfactory.

BPD-DS has been traditionally considered a difficult operation to perform, with more frequent postoperative complications. In our hands this is not true, as the postoperative evolution of our patients does not differ from that after GB. Highly experienced groups have also reported this for the traditional BPD-DS [18]. However, we believe that it is very important to stage the procedure, as recommended by Gagner and DeMaria et al. [9,19], which may have Q3 resulted in the good postoperative outcomes in our study. Staging of the procedure has the additional advantage to offer some patients the possibility of avoiding the second step, what can happen in as much as 73% of the cases, as reported by Ianelli et al. [20]; in our experience 54% of the SO patients do not require duodenal diversion after SG. Technically, BPD-DS exhibits some advantages over other techniques as a second step after SG; the operation is directed toward a "nontouched" area, the duodenum, and this simplifies dissection and decreases anastomotic problems. This has been recently stated by Dapri et al. [21], which demonstrate a similar rate of postoperative complications

Table 2
Percentage and number (parenthesis) of patients taking supplements after sleeve gastrectomy and after single-anastomosis duodenoileal bypass

Supplements	Postsleeve	Post-SADI
No supplements	43% (7)	0%
Multivitamins	43% (7)	68.7% (11)
Iron	37.5% (6)	68.7% (11)
Calcium + vitamin D	43% (7)	68.7% (11)
Extra vitamin D	6% (1)	43% (7)
Vitamin B12	6% (1)	6% (1)
Folic acid	6% (1)	6% (1)
Vitamin A+E	6% (1)	18.7% (3)

SADI = single-anastomosis duodenoileal bypass.

between BPD-DS and resleeve gastrectomy as second step; in addition, complications after BPD-DS are easier to manage than those affecting the higher part of the gastric staple line. Furthermore, our technique with reduction to 1 anastomosis helps in this reduction of potential postoperative short- and long-term complications. The elimination of the mesenteric defect reduces the probability of internal herniation; there remains a huge defect below the ascended ileal loop, which could act as a hernia ring provoking obstruction or even volvulation of the small bowel along the anastomotic loop axis, but up to now, no patient has presented with signs of intestinal obstruction yet.

The present results have to be analyzed with caution. The main limitation of the study is the absence of randomization; patients included are mostly those who have failed to an initial SG, so they should be considered to be to some extent resistant to bariatric surgery. Long-term follow-up is also necessary to know if results are maintained and if complications do not out outweigh weight loss results. Comparison with other technical options as resleeve, plication, or gastric bypass is recommended to draw out definite conclusions.

Conclusion

SADI offers a satisfactory weight loss for those patients submitted previously to a SG. It is a simplified technique, with a low postoperative complication rate and an acceptable rate of nutritional deficiencies, and should be considered as a good option as a second step after SG.

Disclosures

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

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