Single Anastomosis Duodeno-Ieal Bypass after Sleeve for Metabolic Relapse; Do we Need to Re-sleeve?

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ABSTRACT

Background*: Sleeve Gastrectomy (SG) is a widespread bariatric procedure which showed a relative high failure rate (up to 25%), as regards weight loss maintenance and control of obesity related comorbidities where revision in these case is needed. Single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) is emerging as a new effective, safe and simple technique proposed for the first time by Sanchez-Pernaute in 2007 as an alternative for Duodenal Switch (DS) because of its complexity and high rate metabolic complications.* ***Methods****: a retrospective study including 30 patients with failed gastric sleeve to achieve a good control for obesity and its related metabolic comorbidities, were operated upon using a newly emerging technique, SADI-S, to show its effectiveness and necessity to re-sleeve the sleeve pouch done before.* ***Results****: From the thirty patients, only 4 patients needed resleeve, mean preoperative body mass index (BMI) was 46.23 kg/m^2, 28 patients were diabetic, 7 were dyslipidemic, and 6 were hypertensive. After 2 years follow up, mean percentage of excess weight loss (%EWL) was >88%, remission rate for diabetes was 92.9%, for hypertension was 100% and for dyslipidemia was 71%.*
Conclusion*: SADI-S is feasible, safe and effective bariatric procedure with low rate of complications making it a promising weight loss and comorbidity resolution procedure in patients with failed sleeve.*
Key words: *SADI-S. Single anastomosis duodeno-ileal bypass with sleeve. Failed gastric sleeve. Metabolic relapse. Bariatric surgery.*

INTRODUCTION

The first surgical procedure performed to reduce weight was jejuno-ileal bypass that led to very serious complications that sometimes necessitated its revision. Since then, the concept of weight reduction using surgery has evolved and many surgical procedures were introduced [1].

Modern bariatric procedures are based on either gastric restriction alone like gastric banding (GB), sleeve gastrectomy (SG) and gastric plication (GP), or based on gastric restriction combined with gastrointestinal bypass like Roux-en-Y gastric bypass (RYGB), biliopancreatic diversion (BPD) and their modifications [2]. Aim of bariatric procedures extended not only to reduce weight but also to control the obesity related comorbidities including type-2 diabetes mellitus, hypertension, dyslipidemia, knee osteoarthritis and others [3].

These modern procedures can easily be performed laparoscopically with low rate of complications. Although, serious complications continue to occur including staple-line hemorrhage and leaks, intestinal obstruction and up to death [2].

Among these procedures, SG proved an excellent midterm results for both morbid obesity and its related comorbidities [4]. Also, it can be performed in high risk patients [5] or as a part of two-step strategy in super obese patients [6]. This success of SG is attributed primarily to its simplicity, endoscopic access to remnant stomach and preservation of pylorus with its significant functional benefits [7]. However, long-term results showed a relative high (20 – 25%) rate of weight loss failure or even weight regain increasing worldwide redo surgery in recent years, despite good preoperative selection [8,9].

Based on many of meta-analysis done comparing different bariatric procedures, the most effective operation as regards weight loss and comorbidities control is the biliopancreatic diversion with duodenal switch (BPD/DS), but because of its higher surgical complexity and malnutrition risk, it's reserved for superobese patients [10]. The reconstruction in this procedure

is formed via Roux-en-Y technique with alimentary, biliopancreatic and common channel limbs, the same as in RYGB, but with advantages of pylorus preservation. Recently, the interest in single-loop anastomosis techniques is rising due to its simplicity, operative time saving and lower rate of complications. That what Sanchez-Pernaute proposed in his novel technique; the single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S), as an evolution of BPD/DS [11].

Because SG is a relatively new technique, it's not obvious till now which bariatric procedure would be the best option to do for patients presenting with a failure. The proposed procedures include; RYGB, Mini gastric bypass and BPD/DS, among which, SADI-S appears to carry a promising results [11].

PATIENTS & METHODS

Patients:

This is a retrospective study of prospectively collected data that was done from November 2012 to January 2015, where 30 sleeved patients with metabolic relapse underwent SADI-S operation; 20 patients had the sleeve operation in our center and 10 elsewhere. Explicit written informed consent for operation and data recording was obtained from all patients. One surgical team has operated upon all patients at Ain Shams University Hospitals. Patients were followed up postoperatively at our office clinic at 3 months interval for 2 years duration.

Inclusion criteria:

1. Age ≥ 18
2. Percentage of excess body weight loss < 50%
3. Presence of at least one metabolic co-morbid condition relapse (e.g., hypertension, diabetes mellitus, and dyslipidemia)
4. Negative pregnancy test
5. American Society of Anesthesiology scores 1–3
6. Ability to understand instructions and comply with all study requirements

Exclusion criteria:

1. Patients who developed GERD after sleeve gastrectomy.
2. Planned pregnancy in the next 12 months.

Preoperative Workup

A. Radiological:

1. Upper GI dye study (barium or gastrograffin meal).
2. Upper GI endoscopy.
3. CT volumetry for the sleeve pouch.

These are done to evaluate the shape and the size of the sleeve pouch for re-sleeve necessity.

B. *Laboratory*:

1. For DM relapse:
   a. Fasting blood glucose level.
   b. Glycosylated hemoglobin level (HbA1c).
2. For dyslipidemia relapse; serum level of the following:
   a. Total cholesterol.
   b. LDL cholesterol.
   c. HDL cholesterol.
   d. Triglycerides.
3. Endocrinal assessment:
   a. Thyroid function tests; TSH, free T_3 and free T_4.
   b. Serum cortisol level

C. Clinical measurements:

a. Preoperative BMI
b. Blood pressure; for hypertension relapse

Surgical Technique:

Positioning and trocar placement:

At first part of the operation; the operating table was set in anti-Trendelenburg position and the patient was placed in the split-leg position with the operating surgeon standing between the legs. Then, the table was changed to the Trendelenburg position with some left tilt and the surgeon moved to the left-hand side of the patient to perform the second part. Trocar positions were like those used for sleeve gastrectomy.

Steps:

First part of the operation was directed towards the sleeve component; checking its size, shape and necessity to re-sleeve which was judged by the preoperative investigations results (> 250 ml by CT gastric volumetry). Re-sleeve was considered if the sleeve pouch was found wide, or fundus or part of it was left behind that enlarged afterwards. In case of deciding to re-sleeve; a 40 French bougie was used to calibrate (fig 1).

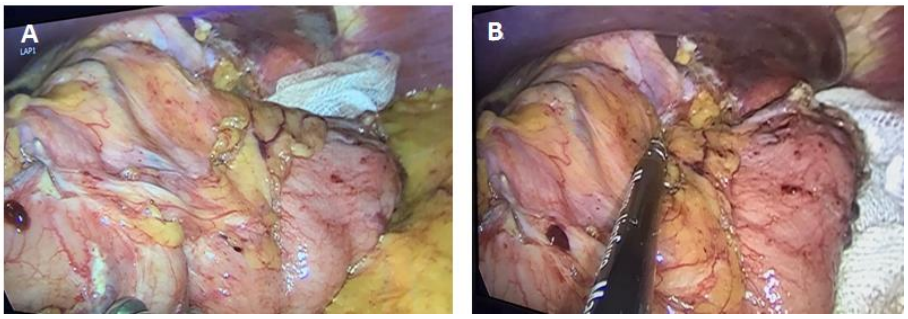

Fig. 1: A dilated pouch was found after being anticipated by preop. Radiological investigations (A), and proposed line of resleeve is being prepared and explored with bougie in position (B).

After that, pylorus was identified and the inferior side of the antrum was dissected and retracted upwards until the gastroduodenal artery was identified. Dissection was progressed through the first 4 cm of the duodenum preserving the right gastric artery. Then the duodenum transection was done with a 60-mm blue cartridge linear endostapler (fig 2).

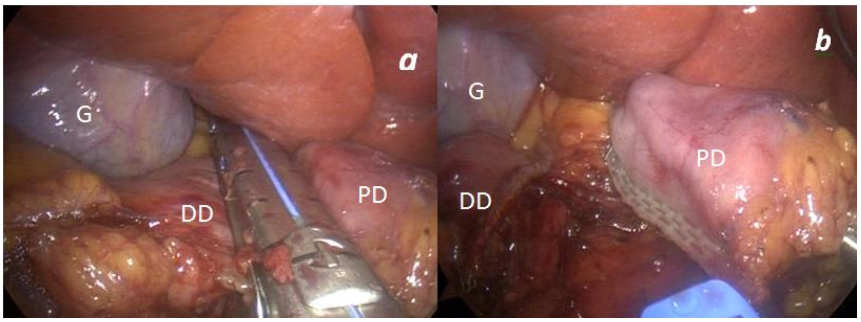

Fig. 2: Dissection of the first 3 – 4 cm of the duodenum creating window under the duodenum through which the stapler blade was passed and transection was done. ***a*** before and ***b*** after the transection. Gall Bladder (GB), Proximal Duodenum (PD) and Distal Duodenum (DD)

The second step was conducted with identification of the ileocecal valve, the common channel was marked at 250 cm measured form ileocecal valve backwards in patients with BMI > 50 kg/m^2 (n = 7) and to be 300 cm in patients with BMI < 50 kg/m^2 (n = 23) (fig. 3). The duodeno-ileal anastomosis was performed as an antecolic, continuous end-to-side hand-sewn single layer anastomosis using 3-0 V-loc™ sutures (Covidien®, Dublin, Ireland sutures) (fig. 4). Diluted half-strength methylene blue dye (200-250 ml) is used for leak testing. Finally, a drain is put towards the duodenal stump.

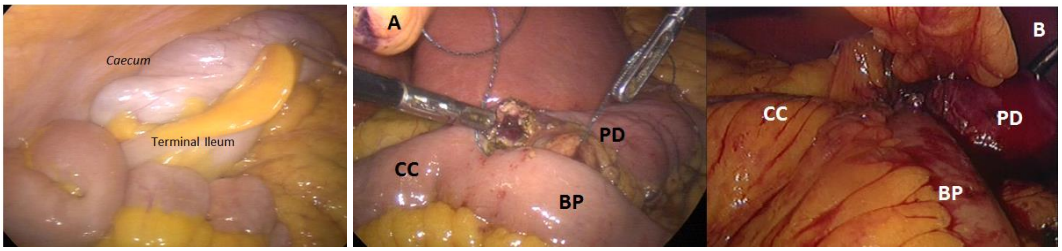

Fig 3: Identification of the ileocecal valve and start measuring backwards

Postoperative:

Patients started drinking on the 2nd postoperative day, and they were discharged on the 3rd to the 5th postoperative day. A low-caloric protein-rich liquid diet was maintained over the 1st month and then other aliments were sequentially introduced. Multivitamins, calcium, vitamin D3, folic acid and iron were prescribed. Patients were encouraged to initiate physical activity from the 2nd postoperative month to avoid muscle mass wasting.

RESULTS

Thirty patients (8 men and 22 women) underwent laparoscopic single anastomosis duodenoileal operation for metabolic relapse after failed Sleeve. The thirty patients mean age was 38 years (range, 28 – 47), mean time between SG and SADI was 23.4 months (18 -36 ms), mean preoperative weight was 121 kg (94 – 142) & mean BMI was 46.23 kg/m^2 (41.2 – 52.36). 28 patients (93.3%) were diabetic (type-2) with mean preoperative fasting glucose level was 162 mg/dl (134 - 211) and mean glycosylated hemoglobin was 6.8% (6.2 – 8.4).

Seven patients (23.4%) suffered dyslipidemia, of which 5 were also diabetic, with mean preoperative total cholesterol level was 247 mg/dl (209 – 346), and mean high-density lipoprotein (HDL) cholesterol was 66 mg/dl (60 – 78) and mean low-density lipoprotein (LDL) cholesterol 152 mg/dl (139–181).

Mean preoperative triglycerides concentration was 197 mg/dl (169 – 311). 6 patients (20%) were still on medical treatment to control hypertension. However, the dose was lower than before the sleeve.

Number of patients	30
Male	8
Female	22
Age (years)	38 (range, 28 – 47)
BMI (kg/m^2)	46.23 (range, 41.2–52.36) (n= 23 < 50 / 7 > 50)
Comorbidities	
DM	28 (93.3%)
Dyslipidemia	7 (23.4%)
Hypertension	6 (20%)

Mean total operative time was 163 min (127 – 243 min), Re-sleeve was needed in 4 patients out of 30 (13.34%); one in patients group from our center (n = 20, 3.34%), and 3 in the remaining 10 (n = 10, 10%) coming from other centers.

No conversions to open surgery were performed and no intraoperative complications occurred. Postoperative complications were limited to one DVT case, successfully treated by heparinization. No recorded incidence of early or late leakage. Mean hospital stay was 5.2 days (range, 4 – 7). No readmission or reoperation was needed in the study.

Mean %EWL was 16.23% at 1 month, 53.56% at 6 months, 67.51% at 9 months and 76.32% at one year. By end of the 2nd year; all patients showed >88 %EWL with mean %EWL 94.26%.

On end of the third month postoperatively; in 26 of the 28 diabetic patients (92.9%); mean glucose level returned to normal (92 mg/dl), glycosylated hemoglobin was ≤ 6% (mean 5.8%) in 21 patients and ≤ 6.5% (mean 6.3%) in 5 patients. Two patients of the 28 diabetics didn't achieve remission of the diabetes with fasting glucose level above 110 mg/dl and HbA1c above 6.5% when measured 3 times 3 months apart, but with reduced dose of antidiabetic therapy.

From the 7 hyperlipidemic patients; 5 (71%) had complete remission of the hyperlipidemia, while 2 patients (29%) maintained hyperlipidemic state, one of them was also diabetic with insulin resistance. All hypertensive patients resumed normal blood pressure (≤ 135 / ≤ 85 mmHg) with no need for any antihypertensives.

	Preoperative		**(n)**	**Postoperative**		**(n)**
	mean	**range**		**mean**	**range**	
Glucose (mg/dl)	162	134 - 211	28	92	78 - 106	26
HbA1c (%)	6.8	6.2 – 8.4		5.8	4.7 - 6	21
				6.3	6.1 – 6.5	5
Total cholesterol (mg/dl)	247	209 – 346	7	142	92 - 196	5
HDL cholesterol (mg/dl)	66	60 – 78		41	39 - 52	
LDL cholesterol (mg/dl)	152	139 – 181		63	51 - 109	
Triglycerides (mg/dl)	197	169 – 311		113	78 - 176	

On follow up laboratory investigations at one year; 4 patients (13.3%) developed low hemoglobin and hematocrit levels without clinical symptoms and were instructed to stick to or even increase the prescribed iron and folic acid formula. Two patients (6.7%) had hypoalbuminemia (≤ 3.4 g/dl) which was related to reduced food intake in one patient, and to low protein diet in the other. All of them were encouraged to increase food intake and make it high protein diet. Also, 5 patients showed below normal vitamin D of them, 2 patients had hypocalcaemia (< 8.4 mg/dl), and all of them received higher doses of vitamin D_3 (5000 – 10000 IU/day). By end of 2nd year follow up all of these laboratory abnormalities subsided.

Postoperative bowel motion rate was 2.2/day, and patients were instructed to lower as much as they can the fat content of their meals to avoid steatorrhea and increased bowel motion rate.

DISCUSSION

Since its introduction as a standalone bariatric procedure; sleeve gastrectomy has been popularized worldwide. Although, it showed a considerable failure rate as regards weight loss and comorbidity remission. This was usually managed by conversion to RYGB, BPD or even re-sleeve, with no consensus about which technique should be performed [4].

BPD has shown rapid maintained weight loss and comorbidity remission in comparison to other procedures, where it combines restrictive and malabsorptive power, beside hormonal changes to achieve its effects [14].

As Rutledge introduced Mini Gastric Bypass operation at 2001 as a simplification of RYGB [12], Sánchez-Pernaute et al. proposed at 2007 SADI-S as a simplification to BPD [13]. The idea was the same as mini bypass to minimize the number of intestinal anastomoses, postoperative anastomotic leak or stricture and less operative time and anesthesia related complications.

In this study, we adopted Pernaute's technique to manage failed SG in 30 patients. Failure of SG was attributed to 2 main reasons; pouch dilatation and eating behavior change.

Dilatation of pouch over the relapse time losing its restrictive effect was due to inadequate excision of the fundus (which is easily distensible and dilatable), wide pouch without good calibration, incompliance of patients to small-sized protein-rich frequent meals and instead, they increase their meal and pouch size progressively, or more than one of these causes. 4 patients in this study could undergo re-sleeve to their dilated sleeve pouch done before, others had uniform dilated pouch that was not suitable to undergo re-sleeve, otherwise, tight pouch is created.

In patients who didn't had pouch dilatation, most patients showed shift of food intake pattern towards high-calorie small-sized meals that was managed well by the malabsorptive effect of SADI.

The procedure showed its ability to achieve optimal weight loss and comorbidity remission over 2 years of follow up, recording >88% mean EWL, 92.9% complete remission of diabetes, 100% for hypertension, and 71% for dyslipidemia. These results are better than those obtained by Balibrea et al. [15], where they recorded <79% mean %EWL,71.4% remission of diabetes,27.7% remission for hypertension with improvement in 22.2% and 31.2% remission for dyslipidemia with improvement in 25%. Also our results were far better than those recorded by Nelson et al. [14]; 62.6 for %EWL, 50% for DM remission, and 42.4% for hypertension remission, but these results were recorded after only 1 year

follow up and may be with continuous follow up, higher results may be obtained.

Sanchez-Pernaute et al. showed results near to ours in his recent study in 2015 [16], where the mean excess weight loss was 72%, complete remission rate was 88% for diabetes, 60% for hypertension, and 40% for dyslipidemia. But in a former 2 studies in 2010 [17] and 2013 [18], Pernaute and his colleagues gave superior results, where mean %EWL exceeded 98.6% & 95% respectively, type-2 DM remission rate was 100% & >90% respectively, hypertension remission rate 93.75% & 58% respectively and dyslipidemia remission rate in 2010 study [17] reached 84%. This difference between the studies might be attributed to the smaller patient sample in his former study [16] (16 patients), and in the latter studies [17, 18], the 50 & 100 patients offered SADI-S with no prior bariatric procedures.

These results of SADI-S, either in our study or in other studies, are near to or even better than those reported with laparoscopic duodenal switch recorded by Bolckmans and Himpens in 2016, where after 10 years follow up, mean total weight loss % was 40.7%, remission rate for DM type-2 was 87.5%, for hypertension was 80.9% and for dyslipidemia was around 93%. Nevertheless, reoperation was needed in 42.5% of patients, 10.6% for hypoproteinemia [19].

The common channel (CC) length varied between different studies using SADI-S technique aiming to achieve good weight loss maintenance and to avoid hypoalbuminemia and hypoproteinemia, it ranged between 200, 250 and 300 cm from ileocecal valve. In our work we choose 250 cm length in 7 patients with BMI > 50 and in the rest we created the anastomosis at 300 cm where BMI was < 50, and only 2 patients suffered temporary hypoalbuminemia that subsided latter by dietary adjustment without surgical intervention.

Sanchez-Pernaute in his proposal at 2007 used 200 cm [13] and in later study in 2010 [17]. In 2013 study, Sanchez-Pernaute et al. [18] used CC of 200 cm in the first 50 patients then shifted to 250 cm in latter 50 patients after encountering high rate of hypoproteinemia (14%), and surgical intervention was needed in 2 patients due to recurrent hypoproteinemia by conversion into a standard duodenal switch with longer alimentary channel.

Balibrea et al. adjusted CC length at 200 (n = 20), 250 (n = 17), or 300 (n = 11), and severe hypoalbuminemia developed in 3 (10%) patients; the two patients at 200 cm and one at 250 that on revision discovered to be at 175 cm form the ileocecal junction. Their hypoalbuminemia needed prolonged total parenteral nutrition, and latter conversion into single-anastomosis duodeno-jejunal bypass creating the anastomosis at 150 cm from the ligament of Treitz was done [15].

CONCLUSION

SADI after failed sleeve is an excellent option especially with competent sleeve component showing good short term preliminary results concerning weight loss and comorbidities control. The technique is feasible, promising, gaining popularity among different bariatric procedures. Although, more and large series studies with longer follow up are needed for more affirmative conclusions.

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