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Impact of Laparoscopic Single Anastomosis Duodeno-ileal Bypass-sleeve Gastrectomy versus Laparoscopic Sleeve Gastrectomy on Blood Sugar Control, OR Time and LOS

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Authors' contributions

This work was carried out in collaboration among all authors. Author MSA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AMAB and MFI managed the analyses of the study. Author TMEG managed the literature searches. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Background: The loop duodenal switch is a risky procedure that requires patients to adopt a for life vitamin and protein supplement regime in order to avoid malnutrition. For that reason, we only advice it for patients who can be very consistent taking multiple vitamins and protein supplements every day for the rest of their lives SADI-S benefits over DS included reduction of the operative risk by eliminating one anastomosis with potentially similar weight loss and health benefits. Purpose to asses blood sugar control between the two procedures in addition to OR time and LOS.

Patients and Methods: The interventions were led at Beni-suef University Hospital between January 2018 and December 2019, after the patients fitted both the inclusions and exclusions criteria. This study consisted of 36 patients which were randomized into 2 groups. Group A: 18 patients assigned for Single Anastomosis Duodeno-ileal bypass – Sleeve Gastrectomy [SADI-S]

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among them 8 were diabetics. Group B: 18 patients assigned for Sleeve Gastrectomy among them 3 were diabetics. Methods: To group A after doing the sleeve gastrectomy in the usual way the duodenum is anastomosed to a loop of ileum while in group B only sleeve is done.

Results: Eight patients (44.4%) of SADI-S group were diabetic (T2DM), all of them were on oral hypoglycemic drugs. Diabetic control was achieved in 100% of them; with 8 cases (100%) reached complete remission which was significant higher than Sleeve gastrectomy group. There was an improvement regarding the postoperative levels of HbA1c in both groups with no statistically significant difference between them.

Conclusion: SADI-S/OADS is more effective than LSG regarding blood sugar control with more operative time and longer hospital stay.

Keywords: SADI; sleeve; diabetes.

1. INTRODUCTION

The loop duodenal switch (SADI-S) is a perfect tool for curing type II diabetes. It adopt removing 80% of the stomach to form a sleeve, which leaves the patient less hungry and more full after smaller meals [1]. It also reroutes the small intestine so that food only goes down the last third of the intestine, meaning less calories are absorbed from each meal. Finally, the SADI-S do even greater improvements in the incretin profile than the gastric bypass, which is powerful in resolving diabetes [2].

The combination lets patients lose 80-95% of their excess body weight, even if they suffer from “super obesity” (BMI > 50). It also leads to remission of Type II diabetes in 95-98% of patients [3].

However, the loop duodenal switch is a risky procedure that requires patients to adopt a for life vitamin and protein regime in order to avoid malnutrition. For that reason, we only advice it for patients who can be very consistent taking multiple vitamins and protein supplements every day for the rest of their lives [4].

SADI-S compared with DS do not apply the Roux-en-Y gastric bypass by fashioning an omega loop, and because of pylorus preservation, bile diversion is unneeded as the natural barrier remains in place. Pylorus provides control of solid stool emptying, reducing the chances of dumping syndrome and assisting in the maintenance of a physiologically based rate of gastric emptying [5].

SADI-S benefits over DS included decrease of the operative risk by abolishing one anastomosis with potentially similar weight loss and health benefits [6].

Reports on outcomes of LSG with patients followed for years are starting to evolve —a fact that will produce long-term efficacy data. However, it is important to point out that many variations in surgical technique causes great difficulty in establishing comparable outcomes at the present time [7]. The bariatric community has made an effort to come to an agreement in major technical issues through the consensus on LSG [8].

2. PATIENTS AND METHODS

- **Group (A):** 18 patients assigned for Single Anastomosis Duodeno-ileal bypass – Sleeve Gastrectomy [SADI-S], 8 were dabetics.
- **Group (B):** 18 patients assigned for Sleeve Gastrectomy, 3 were diabetics.

2.1 Study Sample

The study consisted of 36 patients which were randomized into 2 groups. Patients were enrolled in the study after giving written informed consent.

- **Group (A):** 18 patients assigned for Single Anastomosis Duodeno-ileal bypass – Sleeve Gastrectomy [SADI-S].
- **Group (B):** 18 patients assigned for Sleeve Gastrectomy.

2.2 Inclusion Criteria

1. Patients who had BMIs of 40 Kg/m^2 or more, or between 35 Kg/m^2 and 40 Kg/m^2 with obesity related comorbidities that could be improved if they lose weight.
2. Age (18-65) years old.
3. Patients were generally fit for anesthesia and surgery.

2.3 Exclusion Criteria

1. Previous gastric or duodenal surgery.
2. Endocrine disorders excluding diabetes mellitus.
3. Psychiatric illness.
4. Recent diagnosis of malignancy.
5. Heavy smokers and alcoholics.

Outcome: Systemic hypertension remission was defined with blood pressure maintained below 140/90 without antihypertensive medications for > 3 months after surgery.

2.4 Methods

2.4.1 Operative details

2.4.1.1 Laparoscopic sleeve gastrectomy group

Surgical Technique Positioning: Patients were placed in supine, legs spread (French position), in a steep Fowler (reverse Trendelenburg) position, and the table was slightly tilted right side down for an adequate visualization of the gastroesophageal (GE) junction. The patient was secured to the table. Additionally, above knee elastic stockings was employed to prevent venous thromboembolism.

Pneumoperitoneum was created by direct Veress needle at Palmer's point.

A 15 mmHg CO_2 abdominal pressure was set for all the procedure with 5-6 trocars set up.

The first trocar (10-12 mm) was placed 2-3 cm to the left of the midline 15-18 cm caudal from the xiphoid for the placement of a 10 mm/30 degrees lens.

Both sides of the camera 5- 10 cm away at the same line were placed two 12 mm trocars for both working hands of the surgeon.

The assistant placed a 5 trocar lateral in the left side of the patient (anterior axillary line) 2-3 cm from the last costal bone.

Another 5/10 mm trocar was placed at the xiphoid to liver retraction.

A 10-mm, 30° scope is used. The left lobe of the liver is retracted to expose the entire GE junction and the lesser curve.

The procedure started by cutting the small branches of the gastroepiploic arcade and opening the lesser sac. Then, dissection was carried out along the greater curve, staying very close to it, dividing the branches of both gastroepiploic arteries, until short gastric vessels were divided using an advanced bipolar cutting device or the ultrasonic scalpel. The assistant retracted the omentum laterally during the maneuver and kept repositioning the instrument superiorly to improve exposure of the vessels and avoid bleeding. The remainder of the gastrocolic ligament (without gastroepiploic vessels transection) was severed distally up to 2 cm proximal to the pylorus. The objective of cutting the omentum right by the edge of the greater curve is to minimize the amount of fat attached to the stomach, to make its extraction from the abdomen easier at the end of the operation. The stomach was then lifted to expose its posterior aspect, and all lesser sac attachments of the stomach were freed. This allowed the appropriate positioning of the mechanical suture.

The gastrophrenic ligament was divided and the angle of Hiss was exposed to determine the presence of a hiatal hernia, adding the full exposure of the left crus to complete the dissection.

Stomach division started 4 cm proximal to the pylorus, to preserve a part of the gastric emptying mechanism of the antrum. Prior to the creation of the sleeve, the anesthetist introduced a 36-Fr bougie to guide the stapling and maintain an adequate lumen of the gastric sleeve. The bougie was placed prior to stapling, guiding it to reach the pylorus, and positioned close to the lesser curve. Care was taken not to divide the stomach too close to the incisura angularis to avoid kinking or stenosis at this level. Green (4.8 mm) stapler cartridge was used for the first two firings and blue for the rest. In any case, all of them were 60 mm in length.

Dividing fundus as close as the GE junction as possible, without actually compromising the esophagus 0.5 cm away from the GE junction.

Additionally, the perigastric fat was mobilized, permitting better identification of the esophagogastric junction.

The anesthetist removed the bougie under direct vision to check the final shape of the sleeve. The stomach was removed through one of the 12-mm ports. The integrity of the staple line was tested with the instillation of 50–100 ml of methylene blue in saline solution. Drain was inserted at the operative bed.

2.4.1.2 Laparoscopic single anastomosis duodeno-ileal bypass–sleeve gastrectomy group

For the sleeve gastrectomy part of the procedure (with the operating table under Anti- trendlenburg position and the surgeon positioned between the legs of the patient):

Devascularization of the greater curvature of the stomach with a Harmonic scalpel™ or a Bipolar Ligasure device™

The stomach was then tubularized over a suitable sized oral bougie with linear staplers, commencing 5-6 cm proximal to the pylorus

Then, For the Single Anastomosis Duodeno-ileal bypass part:

The dissection of the greater curvature of the stomach was prolonged through the first portion of the duodenum down to the gastroduodenal artery.

The first part of duodenum was divided with a linear blue cartridge stapler, then the table was changed to the horizontal position and the surgeon moved to the left-hand side of the patient.

The ileocecal valve was identified and 250 cm was measured upwards.

The selected ileal loop was ascended ante-colically without division of the greater omentum, and stapled iso-peristaltic end-to-side duodeno-ileal anastomosis was completed using a 35 mm blue cartridge

3. RESULTS

OR presented in Table 1.

LOS presented in Table 2.

Post operative effect on DM presented in Table 3.

Hb A1 in presented Table 4.

Table 1. Operative time in both groups

	Group A (SADI-S) Mean (SD)	Group B(LSG) Mean (SD)	Test of significance	P-value
Operative time (minutes)	189.9(31.4)	97.5(35.2)	Independent-samples t test t (34) = 8.3	≤0.005**

Table 2. Hospital stay in both groups

	(SADI-S) Mean (SD)	(LSG) Mean (SD)	Test of significance	P-value
Hospital stay (days)	2.9(1)	1.8(0.42)	Independent-samples Mann-Whitney U test	≤0.001**

Table 3. Postoperative effect on DM in both groups

		SADI-S group		LSG group		P value
		No.	%	No	%	
Diabetic (type 2)	Yes	8	44.4%	3	16.7%	
	No	10	55.6%	15	83.3%	0.07
Anti-diabetic drugs after 6 months	Increase	----	----	----	-------	0.024
	Decrease	1	12.5%DM	3	100%DM	
	Discontinue	7	87.5%	----	-----	
	Restart	----	-------	-----	------	
Anti-diabetic drugs after 12 months	Increase	----	-----	------	------	0.05
	Decrease	…….	……	2	66.7%	
	Discontinue	8	100%	1	33.3%	
	Restart	-----	----	----	-----	

Eight patients (44.4%) of SADI-S group were diabetic (T2DM), all of them were on oral hypoglycemic drugs. Diabetic control was achieved in 100% of them; with 8 cases (100%) reached complete remission which was significant higher than Sleeve gastrectomy group

Table 4. HbA1c in both groups at follow up

	Group A (SADI-S) Mean (SD)	Group B (LSG) Mean (SD)	Test of significance	P-value
Preoperative Hb A1c (%)	8.25(0.93)	7.3(0.29)	Independent-samples t test t (7) = 0.95	0.93
Hb A1c after 6 months	6.35(1.47)	6.8(0.5)	Independent-samples t test t (7) = 1.17	0.28
Hb A1c after 12 months	5.97(1.67)	6 (0.3)	Independent-samples t test t (7) = 0.1	0.92

There was an improvement regarding the postoperative levels of HbA1c in both groups with no statistically significant difference between them

4. DISCUSSION

The post-prandial hormone secretion profile after SADI-S is unique in increased GLP-1, glucagon and insulin secretion, in comparison to BPD-DS, which suggests the presence of different endocrine acting mechanisms leading to weight loss and metabolic improvement after the two procedures [9]. The mechanism of the remission of T2DM after bariatric surgery is still not clear. Weight loss due to calorie reduction after restrictive procedures achieves glycemic control. An increase in GLP-1 and NPY due to rapid gastric emptying and a decrease in ghrelin after sleeve gastrectomy play a role in the improvment of diabetes. The nutrients are delivered rapidly to the distal ileum, stimulating GLP-1 and leading to increased insulin release. Malabsorptive procedures exclude the duodenum and upper part of the jejunum, resulting in the inhibition of anti-incretins [2,3,10]. It is known that the gut microbiome and bile acid levels are changed after metabolic surgery. Serum bile acid levels increase after bariatric surgery, and this fact results in decreased postprandial blood glucose levels but results in the maximal secretion of GLP-1. The intestinal microorganism pattern changes after gastric and intestinal tract procedures [11]. In our study the mean operative time was 189.9± 31.4 min in SADI- S group and 97.5± 35.2 min in LSG group with p-value of ≤0.005. There is a statistical difference as SADI-S took more time. This may be explained by: The duodenal dissection took some more time to avoid injury of the duodenum, the gastroduodenal artery or even the common bile duct. The duodeno-ileal anastomosis took more time as, the duodenoileostomy was fashioned as end to side anastomosis to avoid stapling the pyloric ring in case of side to side anastomosis. [12] Similarly Lin et al. [13] reported a mean operation time (min) 95.8 ± 27.8 in LSG. Unlike Topart et al. [14] who reported a mean operative time in SADI-S 100.8 minutes (range 69.9-181.7). While Gebelli et al. [15] reported a mean surgical time 115 min (80-180) in SADI-S.

In our study the mean hospital stay was 2.9 days ± 1 in SADI-S group and 1.8 days ± 0.42 in LSG group with statistical significance between both groups (P-value ≤0.001). On the other hand studies reported a longer hospital stay. Moon et al. [16] reported a mean hospital stay of 4.1 ± 2.7 days in SADI-S. Also Nelson et al. [17] reported a mean length of hospital stay of 4.3± 2.6 days (range, 3-24). Six patients had a prolonged hospital stay (longer than five days) due to decreased oral intake (n=3), atelectasis (n=1), postoperative bleeding (n=1), and duodeno- ileal obstruction with perforation of the small bowel (n=1). While in LSG, Lin et al. [13] reported length of postoperative hospital stay (days) 3.9 ± 1.4. Our study shows shorter hospital stay which could be because of patients' smooth recovery as we had no intra-operative or early post-operative complications.

Eight patients (47.1%) of OADS/SADI-S group were diabetic (type II) (T2DM), all of them were on insulin therapy. Diabetic control was achieved in 100% of them; with all of the eight patients reached complete remission.

Three patients (16.7%) of sleeve group were with T2DM, all of them were on insulin therapy. Diabetic control was achieved in 100% of them; with one case (33.3%) reached complete remission and the other two cases (66.7%) significantly improved requiring only use of an oral hypoglycemic drug.

There is statistically significant difference between both groups. So, glycemic control in diabetic patients was higher in SADI-S than LSG group.

There was an overall improvement regarding the postoperative levels of HbA1c from mean HbA1c preoperative 8.25% in SADI-S to 5.97% and from mean HbA1c 7.3% to 6% at 12 month postoperative, but with no statistically significant difference between them.

In close results Nelson et al. [17] reported a total of 18 patients (26.1%) presented with T2DM at the time of surgery. Of these, 9 (50.0%) had their DM resolved, and six (33.3%) improved by six months after SADI-S. Two patients had not followed-up longer than three months and one remained having DM with the same medication at one year follow-up. One patient who had fasting blood glucose level of 338 mg/dl and HbA1c of 14% preoperatively showed a dramatic decrease of fasting blood glucose level of 79 mg/dl without medication at 6-month follow-up [17]. Also Shoar et al. [18] reported resolution rate of 74.1% for T2DM.

Similarly Sanchez-Pernaute et al. [19] reported that there were 27 patients (54%) with T2DM, of which 14 patients were on insulin therapy and 13 with oral anti-diabetics. Mean glycosylated hemoglobin 7.6% (range: 5.4–10.5) with 59% of the patients over 7%. Mean glucose value returned to normal in all cases (mean glycemia, 97 mg/dl), though five patients had glycemia over 110 mg/dl A strengths of our study are the large sample size compared with most of previous RCTs done and the high follow-up rate, largely achieved by professional study staff getting accurate contact information. Sporadically only during the first three postoperative months. Glycosylated hemoglobin was below 6.5% in all cases with a mean value of 5.4% (4.1–6.5). Only one patient (3.7%) maintains a reduced dose of anti-diabetic therapy 5 months after the operation with normal glycemia and glycosylated hemoglobin. After the first six postoperative months no patient is under anti-diabetic treatment. Mean glycosylated hemoglobin was 4.9% (4.1–6.1) for the 11 diabetic patients reaching 2-year follow-up and 5.2% (4.1–6.3) for the five diabetic patients reaching 3-year follow-up, no one needed anti-diabetic therapy.

No doubt that controlling T2DM is much better after SADI-S than after LSG because SADI-S comprises all the possible mechanisms involved in diabetes improvement, which are a moderate gastric restriction responsible of a moderate reduction in the caloric intake, a bypass of the duodeno-pancreas, a rapid entrance of undigested chymus into the distal intestine, selective fat malabsorption, and in the short run, maintained weight loss. In this way it is easily explained why all diabetic patients have completely resolved their condition after the 12th postoperative month and with no need of specific therapy or diet they are able to maintain normal levels of glycosylated hemoglobin.

5. CONCLUSION

SADI-S/OADS is more effective than LSG regarding blood sugar control with more operative time and longer hospital stay.

CONSENT

Informed consent was taken after explaining the study objective and the procedures to potential participants. Participation was voluntary and we informed the participants that the decision would not affect the quality of care they receive.

ETHICAL APPROVAL

Ethical approval was collected by the institution ethical committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Praveen Raj P, Bhattacharya S, Saravana Kumar S, Sabnis SC, Parthasarathi R, Swamy PDK, et al. Do bariatric surgery-related type 2 diabetes remission predictors add clinical value? A study on Asian Indian obese diabetics. Obes Surg. 2017;27:2113–9. [PubMed] [CrossRef] [Google Scholar]
DOI: 10.1007/s11695-017-2615-8
2. Lee WJ, Chong K, Chen SC, et al. Preoperative prediction of type 2 diabetes remission after gastric bypass surgery: A comparison of DiaRem scores and ABCD scores. Obes Surg. 2016;26:2418–24. [PubMed] [CrossRef] [Google Scholar]
DOI: 10.1007/s11695-016-2120-5
3. Min T, Barry JD, Stephens JW. Predicting the resolution of type 2 diabetes after bariatric surgical procedures: A concise review. J Diabetes Metab. 2015;6:1–5. [Google Scholar]
4. Ersoz F, Duzkoylu Y, Deniz MM, Boz M. Laparoscopic Roux-en-Y gastric bypass with ileal transposition - an alternative

surgical treatment for type 2 diabetes mellitus and gastroesophageal reflux. WideochirInne Tech Maloinwazyjne. 2015;10:481–5. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
DOI: 10.5114/wiitm.2015.54224
5. Mitzman B, Cottam D, Goriparthi R, et al. Stomach intestinal pylorus sparing (SIPS) surgery for morbid obesity: Retrospective analyses of our preliminary experience. Obes Surg. 2016;26(9):2098-2104.
6. Brown WA, Ooi G, Higa K, et al. Single Anastomosis Duodenal-Ileal Bypass with Sleeve Gastrectomy/One Anastomosis Duodenal Switch (SADI-S/OADS) IFSO Position Statement. Obes Surg. 2018;28: 1207.
7. Sumithran P, Prendergast LA, Delbridge E, Purcell K, Shulkes A, Kriketos A, Proietto J. Long-term persistence of hormonal adaptations to weight loss. N Engl J Med. 2011;365(17):1597–604.
8. Pories WJ, Swanson MS, MacDonald KG, Long SB, Morris PG, Brown BM, Barakat HA, deRamon RA, Israel G, Dolezal JM. Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus. Ann Surg. 1995;222(3):339–50.
9. Paschou SA, Papadopoulou-Marketou N, Chrousos GP, Kanaka-Gantenbein C. On type 1 diabetes mellitus pathogenesis. Endocr Connect. 2018;7:R38–R46. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
DOI: 10.1530/EC-17-0347
10. El Khoury L, Chouillard E, Chahine E, Saikaly E, Debs T, Kassir R. Metabolic surgery and diabesity: A systematic review. Obes Surg. 2018;28:2069–77. [PubMed] [CrossRef] [Google Scholar]
DOI: 10.1007/s11695-018-3252-6
11. Guo Y, Huang ZP, Liu CQ, Qi L, Sheng Y, Zou DJ. Modulation of the gut microbiome: A systematic review of the effect of bariatric surgery. Eur J Endocrinol. 2018;178:43–56. [PubMed] [CrossRef] [Google Scholar]
DOI: 10.1530/EJE-17-0403
12. Snell RS. The abdomen: Part III the abdominal cavity in clinical anatomy by Region, 8th Ed. Philadelphia, Walters Kluwer Lippincott. 2008;5:218-224.
13. Lin S, Guan W, Yang N, et al. Short-term outcomes of sleeve gastrectomy plus Jejunojejunal bypass: A retrospective comparative study with sleeve gastrectomy and Roux-en-Y gastric bypass in Chinese patients with BMI ≥ 35 kg/m^2. Obes Surg. 2019;29(4):1352-1359.
14. Topart P, Becouarn G. The single anastomosis duodenal switch modifications: A review of the current literature on outcomes. Surg. Obes. Relat. Dis. 2017;13(8):1306-1312.
15. Gebelli JP, Gordejuela AG, Ramos AC, et al. SADI-S with right gastric artery ligation: Technical systematization and early results. Arq Bras Cir Dig. 2016;29(Suppl 1):85-90.
16. Moon RC, Teixeira AF, Jawad MA, et al. Is single anastomosis duodenal switch superior than Roux-en-Y gastric bypass? A single US institution study. Surgery for Obesity and Related Diseases. 2017;13: S192.
17. Nelson L, Moon RC, Teixeira AF, et al. Safety and effectiveness of single anastomosis duodenal switch procedure: Preliminary result from a single institution. Arquivos Brasileiros De Cirurgia Digestiva. 2016;29(Suppl 1):80–84.
18. Shoar S, Poliakin L, Rubenstein R, Saber AA. Single Anastomosis DuodenoIleal Switch (SADIS): A systematic review of efficacy and safety. Obes Surg. 2018;28(1):104-113.
19. Sánchez-Pernaute A, Herrera MA, Pérez-Aguirre ME, et al. Single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S). One to three-year follow-up. Obes Surg. 2010;20(12):1720-6.

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