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Is Single Anastomosis Sleeve Ileal (SASI) bypass Superior to Laparoscopic Sleeve Gastrectomy (LSG) among Obese Patients in Kirkuk City: A Retrospective Study?

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Bariatric surgery, SASI, LSG, weight loss, comorbidities.

ABSTRACT

In the past twenty years, bariatric surgery has witnessed a huge demand by obese patients, especially those who suffer from related diseases. The current study aimed to compare the outcomes of a single anastomosis sleeve ileal bypass (SASI) and laparoscopic sleeve gastrectomy (LSG). In this cohort retrospective study, 80 obese adult patients who underwent bariatric surgery participated, 40 of them for SASI versus 40 others for LGS surgery in a private hospital in Kirkuk governorate, northern Iraq. All participants were followed up after the sixth and twelfth months after the operation. The outcomes were evaluated through of weighing loss, betterment of comorbidities, and complications that were observed after surgery. The results showed that the percentage of excess weight loss at six months after surgery was analogous between both surgeries while bypassing SASI showed a clear elevation of EWL% at twelve months postoperatively when compared with LGS. As for comorbidities, the improvement in type 2 diabetes mellitus and GERD by bypassing SASI was significantly better than that of LGS. As for postoperative complications, it has been proven that there are fewer complications after SASI surgery compared to LGS, but not significant. It was concluded that bypassing the SASI gave better results, especially after twelve months of the operation, and further articles are needful to compare the outcomes of SASI bypass over a longer term.

1. Introduction

Because of the prevalence of obesity and its causes, it can be considered that losing weight is one of the most important medical treatments currently [1]. Losing excess weight has a significant interest on health, survival, and quality of life, as with adequate weight loss, many patients will feel cured of their comorbidities [2]. Bariatric surgery has confirmed to be the preferred treatment for obesity [3], as it is advised for obese individuals with a BMI super than 40 kg/m^2 or greater than 35 kg/m^2 when related with comorbidities such as diabetes mellitus/ type2 [4], [5]. Although the history of bariatric surgery dates back

to the fifties of the last century through the ileojejunal bypass and the other procedures that followed, which achieved significant weight loss, but they failed to attract obese patients, and they were not appreciated [6]. By the 2000s, the implementation of a laparoscopic approach to composition abdominal operation, including bariatric surgery, and improved safety and better documentation of clinical efficacy led to an increase in surgery among obese patients in several countries [7]. Bariatric surgery includes a wide range of techniques, and the efficacy of each is relatively well-established. The choice of one technique over another is subject to many criteria, such as the clinical and psychological characteristics of the patient, the availability of appropriate infrastructure, the preference of the surgeon, and the expertise of the medical team [8- 10]. Laparoscopic sleeve gastrectomy (LSG) is a common bariatric surgical technique due to its fewer complications compared to the rest, and it is considered a permanent and irreversible surgery [11]. It comprises laparoscopic amputation of further than three-quarters of the largest gastric curvature, resulting in the formation of a minimal parochial tube-like structure with a remaining bulk of 100 ml. This size leads to early satiation and weighing loss [12]. Single anastomosis sleeve ileal (SASI) bypass is a new metabolic operation count on a slight gastric bypass and Santoro operation in which side-to-side sleeve gastrectomy is followed [13]. The first documentation on the impact of SASI in obese patients showed perfect results for the recent surgical technique [14]. The current study aims to compare the short-term outcomes of SASI and LSG surgeries as curing options for obese patients.

2. Patients & Methods

This retrospective cohort analytical study was conducted on 80 obese patients who underwent LSG (figure 1) or SASI (figure 2) bariatric surgery, which spanned from the beginning of 2019 to the end of 2021. Their data was obtained from Al-Salam Hospital, located in the center of Kirkuk Governorate, northern Iraq. Depending on the multidisciplinary protocol [15], inclusion criteria for the two surgeries in the current study were obese individuals with a BMI >40 kg/m^2 or >35 kg/m^2 with at least one co-morbidity, of both sexes and ages of 22 -55 years only who carried out twelve months of follow-up after SASI or LSG surgery.

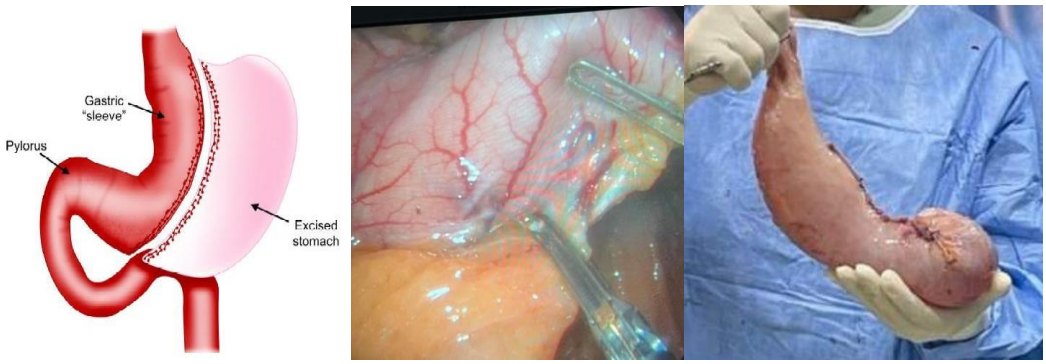

Figure 1: LSG operation.

On the other hand, the exclusion criteria were as follows: patients with incomplete data, less than 18 years of age, pregnant women, who underwent SASI or LSG as revision surgery, and who did not complete at least 12 months of follow-up. A comparison was made between obese patients who underwent one of the obesity operations, either SASI or LSG, in terms of the following: the main variables including gender (male/female), age (years), weight (kg), body mass index (kg/m2), medical comorbidities and postoperative complications. In order to evaluate the surgical outcomes between both types, a follow-up was conducted at 6 and 12 months postoperatively for the following: excessive weight loss, comorbidities, and postoperative complications.

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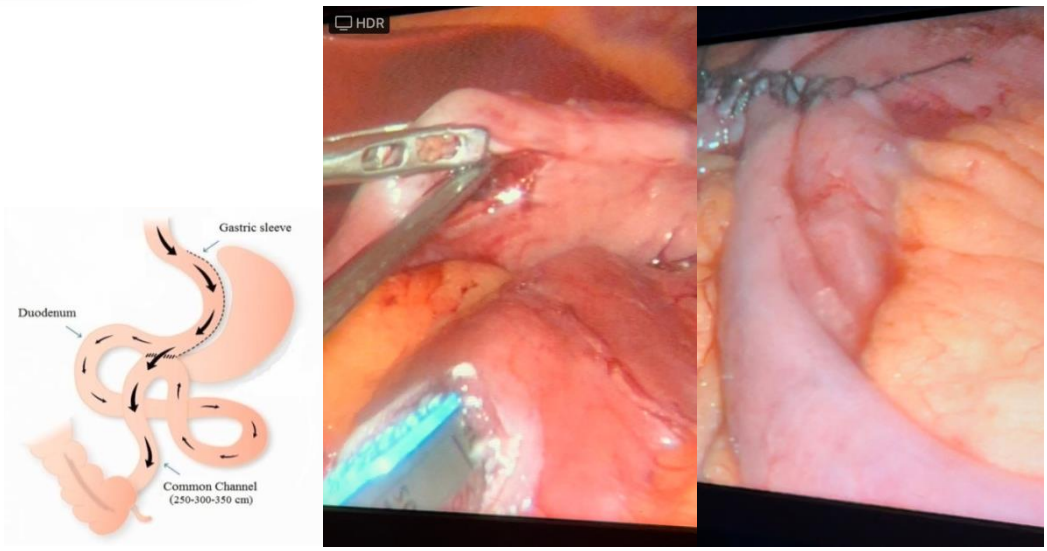

Figure 2: SASI bypass.

2.1 Pre-operative procedures

All obese individuals conducted a preoperative assessment, including detailed history taking of each patient regarding eating habits, comorbidities, and prior medications for morbid obesity, if any. Then a clinical and laboratory checking was complete, including the percentage of glucose in the blood and the lipid profile. The body mass index of each patient was calculated in addition to a complete pre-operative cardiopulmonary assessment for each patient.

2.2 Surgeries

Surgical techniques included both laparoscopic sleeve gastrectomy (LSG) and single anastomosis sleeve ileal (SASI) bypass, which were performed under general anesthesia by expert bariatric surgeons with a five trocar approach (figure 3) as previously described [16]. Pneumo-peritoneum was performed, and then a visible trocar (10 mm) was incorporated. Then, with a direct view, a trocar of diameter (5 mm) was positioned down the xiphoid process to introduce the Nathanson Liver Retractor. Also, two further working trocars (5 mm) were set in the right and left mid-clavicular lines, and a 12 mm trocar for the stapler. Concerning SASI bypass, it is a modern proceeding that necessitate a sleeve gastrectomy with a single gastric-ileal anastomosis (usually, we count 250 cm of small bowel from the duodenojejunal junction). Determining the chosen of surgical techniques was established by a combined decision between the patient and the bariatric surgeon, taking into consideration the consultation of the obesity physician, dietician, and anesthesiologist.

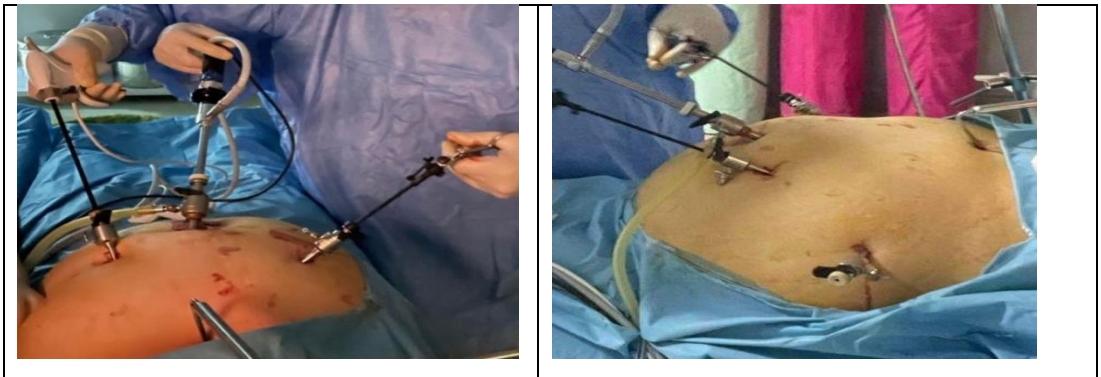

Figure 3: Trocar positions

2.3 Follow-up analysis

After the surgery, all patients were followed up in the outpatient clinic, as presented in table 1. Examinations during the follow-up of patients included measurement and recording of body weight, calculation of body mass index, and recording of excess weight loss (% EWL) and improvement of medical comorbidities, as well as observation of complications at 6 and 12 months after surgery.

Table 1: Dates of the outpatient visit for follow-up after discharge from the hospital.

Visit times	Duration in months (Ms)
once/week	first M
once/month	for 3 Ms
once/every three months	for 12 Ms

2.4 Study Outcomes

Study endpoints were determined according to previously reported standard outcomes by Brethauer and colleagues (2015) in bariatric and metabolic surgery [9] after 12 months of each procedure. Body weight and composition were assessed periodically using bioelectrical impedance analysis. The main outcomes were as follows: first, the percentage of excess weight loss (% EWL) and the change in body mass index. The percentage of EWL was calculated as: [(preoperative weight – weight at follow-up) / excess weight before surgery] x 100. Secondly, the improvement of comorbidity, here comorbidity improvement was monitored by disease control and medications dispensing. Improvement in diabetes mellitus/ type 2 was considered as at least 25% off in fasting plasma glucose and at least 1% off in HBA1c with treatment with hypoglycemic drugs. Thirdly, postoperative complications, the classification of multiples were adapted as Class I to IV according to the Clavien-Dindo Classification.

2.5 Statistical analysis

Using SPSS (version 26), study data were analyzed. The data were presented as either mean ± standard deviation (SD) or as numbers and percentages. Both parametric and nonparametric proceedings were employed for descriptive statistics as appropriate. Differences between both SASI and LGS measures were compared using a chi-square analysis of trends. Taking into consideration that results at $p < 0.05$ were statistically significant.

3. Results

3.1 Basic characteristics

This study evaluated 80 patients who underwent SASI or LSG bypass and finished 12 months of follow-up. As reviewed in the table (2), 10 of them were men while 70 were women, with a mean age of 38.1±6.99 years. The mean weight was 129.88±17.30 (kg), and BMI was 45.60±4.96 (kg/m2). Diabetes mellitus was detected in 31 (38.8%) patients, hypertension in 19 (23.8%) patients, GERD in 16 (20.0%) patients, hyperlipidemia in 13 (16.3%) patients, and obstructive sleep apnea in 8 (10.0%) patients. When comparing

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between 2 surgeries, no clear differences were noted with regard to the basic characteristics mentioned above, as well as the associated diseases.

Table 2: Basic characteristics of obese patients (80) undergoing bariatric surgery

Characteristics	Surgical Techniques			P-value
	Total N=80	SASI N=40	LGS N=40	
Male/ Female	10/70	7/33	3/37	0.18
Age (years) Mean±SD	38.1±6.99	39.1±6.84	37.1±7.09	0.72
Weight (kg) Mean±SD	129.88±17.30	128.57±16.42	131.2± 18.26	0.36
BMI (kg/m^2) Mean±SD	45.60± 4.96	44.82±5.37	46.37±4.45	0.67
Diagnosed Comorbidities NO. (%)				
Diabetes Mellitus	31 (38.8)	17 (21.3)	14 (17.5)	0.49
Hypertension	19 (23.8)	11 (13.8)	8 (10.0)	0.43
GERD	16 (20.0)	5 (6.3)	11 (13.8)	0.09
Hyperlipidemia	13 (16.3)	6 (7.5)	7 (8.8)	0.76
Obstructive Sleep Apnea	8 (10.0)	5 (6.3)	3 (3.8)	0.45

3.2 Wight loss after SASI and LGS

According to the results, weight loss was registered at six- and twelve-month follow-ups after the two surgical techniques, as indicated by a reduction in weight and BMI compared to the preoperative baseline data. There was no considerable difference between SASI and LGS in weighing loss at six months postoperative. Rather, the differences between the two groups were recorded in body weight (80.3±11.2 vs. 87.2±9.5) and body mass index (27.6±2.6 vs. 31.2±3.5) at twelve-month follow-up with statistical significance. Same for EWL% at six months postoperative without a significant difference between SASI and LGS, but bypassing SASI caused a remarkable rising EWL% at twelve months (70.8±14.6) compared to LGS (62.4±11.7) as shown in table (3).

Table 3: Weight loss upon follow-up in the 6 and 12 months after the operation

Variables	Surgical Techniques	

		SASI	LGS	P-value
Wight	6-month postoperative	95.3±11.2	99.4±13.2	0.16
	12-month postoperative	80.3±11.2	87.2±9.5	0.01
	P-value	< 0.0001	< 0.0001	-
BMI	6-month postoperative	32.4± 4.9	34.8±4.6	0.31
	12-month postoperative	27.6±2.6	31.2±3.5	0.03
	P-value	< 0.0001	0.002	-
EWL %	6-month postoperative	45.3±11.4	41.7±10.2	0.12
	12-month postoperative	70.8±14.6	62.4±11.7	< 0.0001
	P-value	< 0.0001	< 0.0001	-

3.3 Associated comorbidities improvements

Twelve months after surgery (table 4), SASI bypass had a statistically greater rate of improvement in diabetes/type 2 than LGS (88% vs. 50%, p = 0.04). Both measures showed approximate improvement in hypertension (p = 0.69), hyperlipidemia (p = 0.56), and sleep apnea (p = 0.1). After all patients with GERD underwent endoscopy before and after surgery during follow-up, SASI bypass showed significant improvement compared to GLS (80% vs. 27%, p = 0.01).

Table 4: Improvement in obesity-associated comorbidities at twelve months after two surgeries.

Comorbidities	Surgical Techniques		P-value
	SASI	LGS	
Diabetes Mellitus/Type 2	15/17 (88%)	7/14 (50%)	0.04
Hypertension	7/11 (64%)	5/8 (63%)	0.69
GERD	4/5(80%)	3/11(27%)	0.01
Hyperlipidemia	5/6(83%)	5/7(71%)	0.56
Obstructive Sleep Apnea	5/5 (100%)	3/3 (100%)	0.1

3.4 Complications

The study did not record any intra-operative complication, as well as deaths. There were 2 (5%) complications after bypass SASI versus 4 (10 %) after LGS surgery, indicating that LGS had a higher complications rate. Knowing that the variation between the two surgeries was not considerable (p = 0.70).

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Where bleeding occurred in one patient and obstruction in another patient after bypassing SASI. While the complications after LGS were as follows: bleeding in two patients, leakage in one patient, and obstruction in another patient. All these complications, whether bypassing SASI or LGS, were from the second to third grade on the Clavien- Dindo classification (table 5). There were 2 (5%) complications after the SASI bypass versus 4 (10%) after LGS surgery,

Table 5: Complications after two surgeries.

Complications	**Surgical Techniques**			**P-value**
	Total	**SASI**	**LGS**	
Bleeding	3 (3.8%)	1 (1.3%)	2 (2.5%)	0.70
Obstruction	2 (2.5%)	1 (1.3%)	1 (1.3%)	
Leakage	1 (1.3%)	0 (0.0%)	1 (1.3%)	
Clavien- Dindo classification				
Class	**SASI**		**LGS**	
I	0		0	
II	1		2	
III	1		2	
IV	0		0	

4. Discussion

The current study compared the results of two bariatric procedures (SASI and LGS). Bypassing SASI has been shown by follow-up results to be more effective for obesity with diabetes mellitus /type 2 and GERD than LGS. In addition to its higher ability to lose weight, especially after a year of operation. SASI can be considered as a new approach to surgical remediation of obesity based on the concept of bipartite division, which is essentially a technical amendment of else proceeding, sleeve gastrectomy with two transitional sections, pioneered by Santoro and his collagen [16]. SASI bypassing requires at least one gastric anastomosis. Practically, this procedure is based on SG, and in a previous study, the addition of an intestinal anastomosis was demonstrated to prompt early satiation and promote DM/T2 alleviation [14]. This bypass allows rapid entry of undigested chyme into the distal intestine, leading to more efficient secretion of GLP-1 and PYY. These hormones reduce the rate at which the stomach empties, making the stomach functionally smaller (functional restriction). As a result, insulin secretion is improved, and central satiety is enhanced [18], [19]. As for LGS, a common bariatric procedure, it is technically the simplest procedure. Although it provides better results, especially in superlative obese patients, but with a possible consequence of regaining weight up to 75% in 6 years post-operation, so it is considered a significant problem [20]. Most baseline variable data in the two groups were convergent, although there were some differences that may reverberate the route each surgical technique was selected for patients. Obese patients who had LGS (37.1 ± 7.09) were lesser in age than patients who had SASI surgery (39.1 ± 6.84); younger patients may be more

likely to regain weight after the operation. Because re-weighting after LGS enable facilely managed with re- sleeve or switching to bypass surgery, this may elucidate the expansion of LGS in younger obese patients [21]. The LGS group had a slightly higher body mass index than) 46.37±4.45 (SASI patients (44.82±5.37). This is consistent with a previous study by [22], which demonstrated that SG surgery is efficient in patients with a mean BMI of about 55 kg/m^2. The proportions of patients who underwent the two surgeries, whether SASI or LGS, were almost similar in terms of their suffering from comorbidities, as no statistically significant difference was recorded. Both surgeries carried out noteworthy weighing loss and BMI with a raise in % EWL after six and twelve months post-operatively. The variance between the two surgical techniques in terms of weighing loss outcomes after six months was not significant, but after twelve months bypassing SASI proved to be significantly better than LGS. Weight loss after the first six months of surgery is based on a restrictive effect during this initial period, followed by a significant onset of the effect of hormonal changes [23], [24]. After SASI, losing weight is primarily caused by a neuroendocrine response resulting from the early receipt of nutrients in the distal gut, prompting the secretion of the distal gastrointestinal hormone and inducing a sense of satiety [13], [25]. The two procedures had similar proportions of amelioration in hypertension, hyperlipidemia, and obstructive sleep apnea.

SASI surgery achieved more statistically greater improvement in diabetes mellitus/type 2 as well as GERD compared to LGS. This significant improvement in diabetes is through several mechanisms, such as restriction of function followed by a marked decrease in caloric intake, a bipartition approach that allows speedy entry of partially digested food (chyme) to amplify the nutritional stimulation of the distal intestine, and crossing of a minimal portion of the meal out of the duodenum to reduce stimulation excessive food intake of the proximal intestine [14], [16]. In a recent study by [26] to compare the outcomes of SASI and SG surgeries using a rodent model with diabetes, they concluded that the SASI procedure is a better alternative because it has perfect outcomes in the treatment of obesity and metabolism with a lower risk of hypoalbuminemia. In another study, [27] evaluated the outcomes and feasibility of their SASI technique for 43 patients who completed twelve months after surgery. Among the 25 patients, remission from diabetes occurred in 95.8% of them. As for the improvement in gastro esophageal reflux disease after bypassing SASI, which reached 80%, it was due to the effect of addition anastomosis between the distal gastric sleeve and the ileum, which lowered intragastric pressure and helped discharge stomach acid and thus contribute to alleviating the symptoms of GERD [16]. In a recent systematic review of the short-term outcome of SASI in the treatment of morbid obesity, which was conducted in 10 studies including 941 patients, the crude percentages of patients with GERD reached 92% [28]. When comparing the complication rates of both surgical techniques, there was no clear significant difference (0.70), which means that both are safe with little risk [29], [30]. One of the limitations of the current study is that the valuation of the results was short-term, about one year after each operation. Although the follow-up of patients after the operation for a longer period of more than several years is also required. In addition, the necessary nutritional parameters, such as some proteins, minerals, and vitamins, were not regularly evaluated after each procedure.

5. Conclusions

Accurately chosen of the bariatric procedure according to every obese patient's condition has the most important role in achieving the best possible outcomes. There was no clear difference between the outcomes of both procedures at six months after the operation. But at twelve months after SASI bypass, a greater decrease in body weighing and BMI, increased % EWL, and better improvement in diabetes/type 2 and GERD were observed compared to LGS. The study recommends conducting another study to estimate the long-term outcomes of both surgical procedures, as well as other prospective studies comparing SASI with obesity surgery techniques.

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