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Laparoscopic Single Anastomosis Sleeve-Jejunal Bypass vs Laparoscopic Mini-Gastric Bypass in Morbid Obese Patients and Resolution of Diabetes Mellitus, A Single Centre Experience

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ABSTRACT

Background: The most effective therapy for morbid obese patients now available is bariatric surgery, which can help patients losing weight effectively and sustainably while also improving their quality of life and comorbidities associated with obesity. Worldwide, the one anastomosis gastric bypass (OAGB) technique is one of the most performed bariatric surgeries.

Objective: The study's objective was to compare the outcomes of the OAGB, with those of the single anastomosis sleeve jejunal bypass (SASJ) as a new method in terms of weight reduction, operating time, postoperative complications, and impact on comorbidities three years following surgery.

Patients and Methods: This prospective randomized study included a total of 200 morbidly obese patients undergoing OAGB or SASJ for the treatment of morbid obesity and comorbidities, attending at Department of the bariatric Surgery, tertiary care hospital, Ain Shams University Hospitals. The included subjects were divided into two equal groups: 100 each; SASJ and OAGB groups.

Results: The operative time was prolonged in SASJ group (104.7 minutes) compared to OAGB group (76.4 minutes). OAGB group had significant lower Body mass index (BMI) mean as well as significant lower body weight mean at all time intervals through the 3 years follow up. OAGB group had 92% resolution of comorbidities while 68% of SASJ group had resolution. Post-operative HbA1c showed rapid improvement in both groups. Concerning the post-operative complications, no statistically significant differences.

Conclusion: It could be concluded that OAGB and SASJ bypass are efficient bariatric surgeries for weight reduction and comorbidities resolution with favorable outcomes in OAGB group.

Keywords: Laparoscopic Single anastomosis sleeve-jejunal bypass (SASJ), Laparoscopic Mini-gastric bypass (OAGB), Morbid Obesity.

INTRODUCTION

Obesity is a serious health problem that lowers life expectancy and lowers quality of life due to the increased risk of diabetes, cardiovascular disease, and osteoarthritis [(1)]. Effective treatment and prevention are necessary due to the rising incidence of obesity and associated diseases. Prior research has shown that bariatric surgery is linked to better and more sustained weight reduction than non-surgical treatment [(2)]. Therefore, bariatric surgery is the most effective therapeutic option that not only encourages weight reduction but also improves the comorbidities in patients with a body mass index above 35 kg/m^2. However, a number of problems might arise during surgery [(3)].

The sleeve gastrectomy (SG), the Roux en-Y gastric bypass (RYGB), and the mini-gastric bypass are the most performed bariatric surgeries globally and have been shown to give outstanding metabolic and bariatric results. A single anastomosis duodenal-ileal bypass with a sleeve gastrectomy or a one loop duodenal switch are two more successful procedures that the IFSO has recently authorized (SADI-S) [(4)].

A more modern operation known as SASJ includes performing SG with a gastrojejunostomy established between gastric sleeve and jejunum two meters distal to duodenojejunal junction [(5)]. The transit bipartition and sleeve gastrectomy procedures are modified in this operation, but it has additional benefits. There is less possibility of leaking since there are fewer anastomoses. Additionally, we do not separate the mesentery, which decrease the occurrence post operative internal hernia. With a shortened biliopancreatic limb, some people believe it to be a modification of single anastomosis sleeve ileal bypass (SASI) bypass [(6)].

SASJ the main concern of our study, appears to be safer than the SASI operation in morbid obese patients with nutritional deficiencies and more simple because of its better surgical ergonomics [(6)].

The study's objective was to compare the outcomes of the most common bariatric treatment, the OAGB, with those of the SASJ as a new bariatric surgery in aspects of weight loss, operating time, post operative complications and resolution of comorbidities three years following surgery.

PATIENTS AND METHODS

This prospective randomized study included a total of 200 morbidly obese patients undergoing OAGB or SASJ for the treatment of morbid obesity and comorbidities, attending at Department of the bariatric Surgery, tertiary care hospital, Ain Shams University Hospitals. This study was conducted between June 2019 and April 2022.

The included subjects were divided into two equal groups: 100 each; SASJ and OAGB groups. Data from

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participants was collected, and patients were subsequently monitored over three years. The interdisciplinary team and the patients jointly decided on the procedure to use.

Inclusion criteria:
All patients who were at least 18 years old were included.
Exclusion criteria: Patients who were under 18 or over 60, had undergone any past gastrointestinal surgery, had mental contraindications, were pregnant, or had any other medical problems prohibiting the use of laparoscopy were excluded.

Preoperative BMI and postoperative BMI were used to calculate the BMI difference for each procedure at each period.

A multidisciplinary team examined the patients' medical, endocrinological, dietary, and psychological histories prior to surgery. Chest radiographs, cardiology evaluations, and blood tests were all part of the preoperative assessment. Surgery-related mental health contraindications were assessed by psychiatric counselling. Additionally, patients' BMI and co-morbidities such obstructive sleep apnea, hypertension, and diabetes mellitus were evaluated.

Following surgery, patients were observed for 3 years at intervals of 3, 12, 24, and 36 months to see whether their BMI had decreased, their co-morbidities had disappeared, and the length of the operation.
The formula for calculating excess weight loss, or EWL, is as follows: (preoperative weight - postoperative weight at each interval) x 100 / (preoperative weight - ideal weight), where ideal body weight is determined as a weight that corresponds to a BMI of 25 kg/m^2.

Surgical procedures:
Laparoscopic OAGB:
A total of five ports were implanted while the patient was in the anti-Trendelberg posture. Following the removal of the adhesions above the gastric fundus, a long, thin gastric pouch calibrated with a 36- Fr bougie was implanted starting at the incisura angularis and ending at the angle of His using a linear stapler. A novel anastomosis was created between the 200 cm-long jejunal omega loop and the bottom of the gastric tube. A running suture was used to complete the anterior portion of the gastro-jejunal anastomosis, which was done by linear stapler.

Laparoscopic SASJ:
A total of five ports were implanted while the patient was in the anti-Trendelberg posture. Following the larger curvature's dissection until clear identification of left crus of diaphragm, gastric resection was started 4 to 5 cm from the pylorus along 36 Fr calibration tube, and a sleeve was completed using linear staplers. Then, using a linear stapler, gastrojejunostomy was done between distal end of gastric sleeve and jejunum two meters distal to duodenojejunal junction,

Ethical Considerations:
An approval of the study was obtained from Ain Shams University Academic and Ethical Committee. The patient data were anonymous. Data presentation were not by the patient's name but by diagnosis and patient confidentiality was protected. An informed consent was signed from all participants, it was in Arabic language and confirmed by date and time. Confidentiality was preserved by assigning a number to patients' initials and only the investigator knew it. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis
SPSS for Windows 20.0 must be used for analysis. Number and percentage, range, median, and interquartile range, or range, mean, and standard deviation (for numerical parametric variables) are all acceptable ways to show data (for categorical variables). The independent t-test and the mean difference and its 95 % confidence interval (CI) (for the numeric parametric variables) or the chi-squared test and the risk ratio and its 95% CI are to be used to assess differences between two independent groups. We carried out the Shapiro Wilk and Kolmogorov-Smirnov tests. For comparing the means of the two groups—OAGB and SASJ we utilised the Mann-Whitney test. BMI was compared between groups before surgery and one year afterward using the Wilcoxon-signed rank test. P value < 0.05 was considered significant.

RESULTS
During this study, 230 patients were evaluated for eligibility and 200 morbid obese patients were recruited. The included subjects were divided into two equal groups: 100 each; SASJ and OAGB groups.

Table (1) shows the basic demographic date of participants. No statistical difference between groups regarding age, gender, preoperative weight, height, BMI. Patients at SASJ group had significant lower preoperative HbA1c compared to OAGB group. There was significant difference in preoperative comorbidities between the 2 groups.

Table (1): Baseline characteristics of included participants

	SASJ	MGB(OAGB)	p-value
Number of patients	100	100	NA*
Age (years) (mean±SD)	40.88±12.7	38±11.6	0.10
Gender Male female	 30 70	 42 58	0.07
Pre-operative weight, Kg (mean±SD)	129.2±24.4	126.6±23.1	0.44
Height, meters (mean±SD)	1.75±0.06	1.76±0.07	0.27
Pre-operative BMI (kg/m^2) (mean±SD)	41.9±8.7	40.6±8.13	0.25
Pre-operative HbA1c (%) (mean±SD)	7.2±1.42	7.9±1.8	0.011
Pre-operative Co-morbidities DM HTN DM & HTN Dyslipidemia	 26 10 26 38	 42 6 30 22	0.02
Mortality NO YES	 100 0	 100 0	NA*

There is statical difference between the two groups in Post operative weight, BMI and EWL at all time intervals during the 36 month follow up. MGB group had significant lower post operative body weight and BMI compared to SASJ group. MGB group had significant higher post operative EWL compared to SASJ group (table 2).

Table (2): EWL, BMI, and Weight loss difference according to type of surgery

	MGB(OAGB)	SASJ	p-value
BMI 1 month	37.8±7.6	41.4±8.8	0.002
BMI 3 months	34.3±6.8	38.9±8.1	0.0001
BMI 6 months	31±5.85	36.5±7.2	0.0001
BMI 12 months	27.5±4.8	34.2±6.7*	0.0001
BMI 24 months	24.4±3.5	31.9±6*	0.0001
BMI 36 months	22.2±2.5	29.8±5.6	0.0001
EWL 1 month	21.5±5.1	2.8±0.32	0.0001
EWL 3 months	49.4±12.1	20.8±4.3	0.0001
EWL 6 months	75.2±14.4	38.2±7.4	0.0001
EWL 12 months	101.8±18.3	57.4±12.4*	0.0001
EWL 24 months	123.4±26.7	74.3. ±15.8	0.0001
EWL 36 months	138.4±32.9	88.6±19.6	0.0001
Weight 1 month	117.8±21.6	127.6±24.6	0.003
Weight 3 months	106.9±19.2	119.9±22.5	0.0001
Weight 6 months	96.7±16.2	112.3±20	0.0001
Weight 12 months	85.84±13.1	105.5±18.8*	0.0001
Weight 24 months	76.1±9.2	98.4±17.2*	0.0001
Weight 36 months	69.2±6.3	92±16	0.0001

MGB group had significant lower operative time compared to SASJ group (table 3)

Table (3): Difference in the operative time between both groups.

	MGB	SASJ	p-value
Operative Time (min.) (mean±SD)	76.4±8.12	104.7±10.38	0.0001

MGB group had significant lower post operative HbA1c compared to SASJ group. The resolution of comorbidities in MGB group was significantly higher than resolution in SASJ group (table 4).

Table (4): Post-operative HbA1c and resolution of co-morbidities in each group.

	MGB	SASJ	p-value
Resolution of co-morbidities			0.0001
No change	8	32	
Complete resolution	56	14	
Partial resolution	36	54	
Post-operative HbA1c	5.56±0.85	6.3±1.5	0.0001

Concerning the post-operative complications, no statistically significant differences between them. OAGB showed 4 cases of bleeding that managed conservatively, and one case managed by operation oversewing of suture line and evacuation of hematoma. Two cases of marginal ulcer were managed by medical treatment and one minor leakage that managed conservatively. SASJ group had 6 cases of bleeding in which 4 cases were managed conservatively and two cases managed by operation oversewing of suture line and evacuation of hematoma. Two cases of leakage, one managed by stent endoscopically and laparoscopic drainage of the collection and one managed by surgical conversion to RYGB, three cases reported postoperative GERD (Table 5).

Table (5): post-operative complications in each group.

	MGB	SASJ	p-value
Post operative complication			0.14
Bleeding	5	6	
Managed conservatively	4	4	
Managed operatively	1	2	
Marginal ulcer	2	0	
Leakage	1	2	
GERD	0	3	

DISCUSSION

Bariatric surgery is the most effective therapy for morbidly obese patients that lead to successful and long-lasting weight loss, resolution of comorbidities and improvement quality of life [7]**.** OAGB and SG are the most common bariatric surgeries to be done [8].

Our Study found no statistically significant differences in preoperative BMI, age, or gender between the studied groups (p values = 0.10, 0.07, and 0.25, respectively).

As regards the operative time, SASJ group's operation took longer time (104.7 minutes) than the OAGB group's (76.4 minutes) (p value = 0.0001).

Elrefai *et al.* [9] conducted a prospective study that enrolled 60 obese cases to compare outcomes of various bariatric surgeries regarding weight loss, post operative complications, resolution of comorbidities and quality of life and reported operative time of SASJ group of (106.75 minutes) which was prolonged compared to other procedures of LSG and OAGB.

This was in line with the findings of **Khalaf *et al.*** [8] and **Romero *et al.*** [10] who found that the average operating time for the SASI operation was 98.8 minutes and 116.3 minutes, respectively (range, 60–270 minutes). The SASJ method was shown to have a significantly longer operating time in different research by **Arslan *et al.*** [11] with a mean value of 192.8 minutes.

As regards Excess Weight Loss (EWL), according to the findings of our study, the SASJ group succeeded in achieving EWLs of 38.2, 57.4, 74.3, and 88.6% at 6, 12, 24, and 36 months, respectively; nevertheless, this was substantially lower than the OAGB group (p=0.0001).

Elrefai *et al.* [9] reported 53.47 and 77.61% EWL at 6 and 12 months respectively with no statistically significant differences with LSG and OAGB groups. This discrepancy with our results would be because of the small sample size involved in the study.

Furthermore, **Khalaf *et al.*** [8] reported that % EWL had mean values of 58.7 and 86.9% at 6 and 12 month follow up respectively

Sewefy *et al.* [6] conducted research in which 150 morbidly obese patients received SASJ bypass, and the results showed that 85% of the cases were still alive a year later. **Alamo *et al.*** [12]'s assessment also included substantial weight reduction levels of 31.9%, 56.9%, and 76.1% of weight lost over 3, 6, and 12 months following SASJ bypass surgery, respectively. However, there was no comparison between the two earlier trials and other bariatric surgeries.

As regards resolution of comorbidities, our study results revealed that OAGB group had 92% resolution of comorbidities while 68% of SASJ group had resolution with significant differences between them **(p=0.0001).** Post-operative HbA1c showed rapid improvement in both groups while significant improvement was found in OAGB group compared to SASJ group **(p=0.0001).**

Caloric intake reduction and quick transport of the meal components to the distal colon, which causes early satiety and the release of antihyperglycemic

hormones, may both contribute to T2DM remission following the SASJ operation [13].

Elrefai *et al.* [9] revealed that there were no significant differences between the study groups in the resolution of the co-morbidities of diabetes and hypertension (p values=0.819, 0.545, respectively), with all eleven cases of DM in the SASJ group showing complete resolution at 3 months and remaining with the same condition throughout the study follow up .

This was consistent with **Sayadishahraki *et al.*** [14] who revealed rapid improvement of diabetes and reported that all of the patients who underwent Single-Anastomosis Sleeve Jejunal Bypass, showed improved diabetes mellitus during the 6 months follow up and stop medication as well as insulin therapy.

Sewefy *et al.* [6] revealed that the %EWL reached 85% at 12 months follow up. Resolution of DM occurred within two months after surgery.

Arslan *et al.* [11] observed a substantial drop in glycosylated haemoglobin levels three months after SASJ surgery, from 9.58 to 6.56%.

In addition, **Mahdy *et al.*** [13] examined the effects of the SASI (single anastomosis sleeve ileal) surgery, which uses the same basic principles as SASJ, on 61 patients who had type 2 diabetes. The study had a one-year follow-up period. Finally, they showed excellent short-term results, except for five patients whose diabetes was well controlled after three months and who needed to gradually quit taking insulin and hypoglycemic medications.

As regards operative and postoperative complications, our study results showed that there were no significant statical differences between the two groups. OAGB showed 4 cases of bleeding that managed conservatively, and one case managed by operation oversewing of suture line and evacuation of hematoma. Two cases of marginal ulcer were managed by medical treatment and one minor leakage that managed conservatively.

SASJ group had 6 cases of bleeding in which 4 cases were managed conservatively and two cases managed by operation oversewing of suture line and evacuation of hematoma. Two cases of leakage, one managed by stent endoscopically and laparoscopic drainage of the collection and one managed by surgical conversion to RYGB. Three cases reported postoperative GERD.

Elrefai *et al.* [9] reported that there was no difference between the three study groups in postoperative complications, and they also noted that the SASJ procedure was safe for the early postoperative course because there were no cases of leakage, peritonitis, or bleeding, and not a single patient developed GERD as a result of the procedure.

The influence of gastrojejunostomy lower the pressure inside gastric sleeve and lower risk of occurrence of GERD, may be the explanation for this discovery. However, 20% of our subjects in the LSG group progressed to GERD.

Because of this, a significant advantage of this novel treatment over LSG is the observed low incidence of postoperative GERD following SASJ [11].

Sewefy *et al.* [6] revealed that bleeding was in two patients (1.3%). one patient presented by hematemesis and melena due to intraluminal bleeding from anastomotic staple line was managed by endoscope by injection of adrenaline and cauterization using argon plasma. The other patient had intra-abdominal bleeding which was managed by laparoscopic exploration which found omental bleeding managed by cauterization. One patient (0.7%) had gastric leak and managed by internal endoscopic drainage. Five cases had biliary gastritis (3.3%) and improved completely by conservative management.

The incidence of major complications after SASJ bypass was 8.6%, compared to 8.7% for sleeve gastrectomy [3], 8.15% after SADI [15], and 10% for SASI [16]. Most of these complications were minor and managed conservatively.

The strength points of this study are that it is prospective study design and having no patients lost to follow-up in three years of the study. It included relatively larger sample size relative to the previous studies and this represents a significant low risk of publication bias. It is the first study to evaluate SASJ procedure compared with OAGB procedure with that number of patients and 36 months follow up.

The limitations of the study are worthy of mention, it is single center study experience with a limited target population and lacking representation of the wider patient population, reducing their external validity. Multicenter studies allow for comparison of effects between centers, which provide insight into the generalizability of data and effects of the new procedures across hospitals. Secondly, we did not evaluate the post operative health related quality of life and nutritional deficiency.

CONCLUSION

It could be concluded that both OAGB and SASJ bypass are efficient bariatric surgeries for weight reduction and comorbidities resolution with favorable outcomes in OAGB group. Laparoscopic SASJ bypass is a safe, straightforward treatment with a similar safe post operative results to OAGB for treating morbidly obese patients and resolution of co morbidities.

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Author contribution: Authors contributed equally in the study.

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