**Comparative study between laparoscopic sleeve gastrectomy and single anastmosis sleeve ileal bypass in management of morbid obese patients**

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Abstract

**Background:** The frequency of obesity and overweight continues to increase significantly and has become one of the most important health problems of the century**.** Bariatric surgery has been recognized as the most effective treatment of morbid obesity as compared to medical and conservative treatments. The main aim of this study was to compare the outcome of SASI bypass with that of SG in regards weight loss duration, maintenance, failure, cost, time of operation, learning curve and postoperative complications, improvement in comorbidities at 12 months of follow-up. **Methods:** This prospective randomized clinical study was conducted in General Surgery Department of Benha University Hospital. A total of 40 morbid obese non-sweet eaters’ patients will randomly divided into two equal groups, group I a number of 20 patients will undergo laparoscopic SG and group II of 20 patients will undergo laparoscopic SASI. The study duration of the study ranged from 6-12 months. **Results:** In the current study, there is no significant difference between the two studied groups regarding 3 months postoperative laboratory parameters. There is a significant difference between the two studied groups regarding TG, LDL, FBS, and HbA1c 6-months postoperative. There is a significant difference between the two studied groups as regard TC, TG, LDL, HDL, FBS, and HbA1c 12-months postoperative. There a significant decrease from preoperative to 12 months postoperative regarding BMI in both groups. There is no significant difference between the two studied groups regarding early complications. There is no significant difference between the two studied groups regarding late complications. **Conclusion:** Both SASI and LSG procedures were safe and effective in the treatment of morbid obese. Both procedures resulted in significant improvement in BMI, lipid and glycemic profiles. SASI procedure results in better outcome as regard the improvement in both lipid and glycemic profiles, but it was comparable with LSG as regard operative data and rate of early and late complications. Further comparative studies with larger sample size and longer follow-up are needed to confirm our results and to identify risk factors of adverse events.

Key words: laparoscopic sleeve gastrectomy - single anastmosis sleeve ileal bypass - SASI - morbid obese patients

**1.Introduction**:

Bariatric surgery (BS) is well recognized as the best treatment for morbid obesity. According to the World Health Organization, the worldwide prevalence of obesity has seen a threefold increase since 1975. Approximately 39% of adults with age ≥18 years were overweight in 2016, and 13% among them were obese. Obesity is the second leading cause (after smoking) of the preventable deaths in the United States. Currently, United States ranks among first in high-income countries for the highest body mass index (BMI), 1 of every 3 adults have a BMI over 30 kg/m2 **(1).**

Among the different types of bariatric procedures, sleeve gastrectomy (SG) is today one of the most performed worldwide. It was initially designed as a step procedure for super-morbid-obese (SMO) patients; it has become a primary procedure in the last years. Due to its technically feasibility, it was quickly adopted by all the bariatric surgical groups. Different studies have demonstrated its safety and effectiveness. SMO patients become a challenge due to their excess weight and morphological characteristics, but also for the morbidity conditions associated. This group of patients is mostly benefited by procedures with strong malabsorptive component (**2)**.

Laparoscopic sleeve gastrectomy (LSG) was initially proposed to be a first-step surgery for SMO patients in a staged strategy for a definitive bariatric procedure. However, due to its simplicity and promising results in the management of comorbidities associated with obesity, LSG is now considered a definitive operation. According to different studies, LSG not only provides satisfactory and durable weight loss but also helps in the resolution of several significant comorbidities, including metabolic, cardiovascular, renal, and respiratory disorders. More importantly, it helps in reducing mortality rate and improves the quality of life in obese patients (**3).**

The strategy to manage SMO patients is usually guided by staged procedures. During the first stage a LSG is performed, and several months later, with some weight loss and better control of other comorbid conditions, the definitive procedure is done. This strategy is defined to reduce the risk of complications of a major bariatric procedure in such complex patients (**2)**.

Single anastomosis sleeve ileal bypass (SASI) procedure appears as a new metabolic and bariatric surgery based on Santoro's operation, in which a sleeve gastrectomy is followed by a side-to-side gastroileal anastomosis (**4).**

The main aim of this study was to compare the outcome of SASI bypass with that of SG in regards weight loss duration, maintenance, failure, cost, time of operation, learning curve and postoperative complications, improvement in comorbidities at 12 months of follow-up.

**2.Patients and Methods**

This prospective randomized clinical study was conducted in General Surgery Department of Benha University Hospital, patients were randomly selected from outpatient clinic with morbid obesity.

A total of 40 morbid obese non sweet eaters patients were randomly divided into two equal groups:

* **Group I** : a number of 20 patient underwent laparoscopic SG
* **Group II** : a number of 20 patient underwent laparoscopic SASI.

The Study period was 1 year.

**Inclusion criteria :** The study included patients in whom surgical management is indicated:

1. Patients with BMI >\_ 40.
2. Patients with BMI 35 – 40 with obesity related comorbidities (e.g. hypertension, hyperlipidemia, type 2 diabetes mellitus, obstructive sleep apnea, obesity hypoventilation syndrome, non alcoholic fatty liver disease and sever artheritis).

**Exclusion criteria:**

1. Age less than 18 years old or older than 59 years old.
2. Patients not fit for general anesthesia (e.g. patients with sever heart disease or untreatable coagulopathies).
3. Patients with contraindications to insufflation as those with sever cardiovascular or sever restrictive respiratory diseases.
4. Patients with major psychiatric illness.
5. Pregnant patients.

**All patients included in the study were subjected to the following:**

The included patients are subjected to:-

**Detailed history taking including**:

1. Personal data: Name, age, sex, occupation, address.

2. Past history of previous interventions.

3. Hospital diagnosis

4. Date of admission in hospital

5. Medical & Past history

1. **Careful clinical examination :**
* **General** :
* **Vital signs** (Blood pressure, Temperature, Heart rate, Respiratory rate),
* **Signs of** (Pallor, Cyanosis, Jaundice, and Lymph node enlargement).
* **BMI**



**3-Investigations:**

* **Laboratory:**
* **Complete blood picture (CBC):** hemoglobin concentration (Hb %), red blood cells (RBCs), white blood cells (WBCs), platelet count.
* **Renal function test:**  serum creatinine, blood urea and urine analysis.
* **Liver Test Profile:** Serum aspartate and alanine aminotransferases (AST and ALT), serum albumin, serum bilirubin, serum gamma-glutamyl transferase (GGT), prothrombin time and international normalized ratio (INR).
* **Lipid profile (**Total lipids, Serum total cholesterol, serum HDL cholesterol, Total cholesterol/HDL cholesterol ratio, Serum triglycerides, Serum Phospholipids, LDL, VLDL, HDL**).**
* **Imaging:**
* **Pelvi-abdominal US.**
* **CT pelvi-abdominal with contrast.**
* **Upper GI endoscope.**

**Surgical technique:**

Parameters of the study included :

**1 . Preoperative :**

Taking history , clinical examination and assessment of hemodynamics (non invasive blood pressure (NIBP) , heart rate (HR), respiratory rate (RR) and Oxygen saturation (Spo2) .

**2 . Intraoperative :**

* Preoperative check-up was done .
* In operating room , venous access was secured on the nondominant hand of every patient by 18G/20G cannula
* Intravenous (IV) fluid was started with 500 to 1000 ml of normal saline before anesthesia .
* Baseline parameters including heart rate (HR) , systolic blood pressure (SBP) , diastolic blood pressure (DBP) , mean blood pressure (MBP) , respiratory rate (RR) and SpO2% were recorded .
* These were recorded again every 5 minutes during the duration of operation .
* All loading fluids and drugs were to be given at room temperature which was kept at 25 celsius degrees .
* The attending anesthestists recorded the amounts of preoperative & intraoperative fluids and duration of surgery .

**3 . Postoperative :**

* After surgery , patients were observed in the postanesthesia care unit for 2 hours where the vital signs were recorded .

 **E)-Administrative considerations:**

* An Official permission was obtained from the ethical committee of the department of General Surgery, Faculty of Medicine, Benha University
* An official permission was obtained from the Institutional Research
* Approval from ethical committee in the faculty of medicine (Institutional Research Board IRB)

**F) - Ethical consideration:**

* Informed consent was obtained from all participants after being informed about the aims and process of the study as well as applicable objectives.
* The study procedures were free from any harmful effects on the participants as well as the service provided.
* The principal investigators have kept individual data as private information safely. There was no extra fee to be paid by the participants and the investigators covered all the costs in this regard.

**7)Data management and Statistical Analysis**

 Data entry, processing and statistical analysis was carried out using using SPSS version 20**(Statistical Package for the Social Sciences).** Tests of significance (Kruskal-Wallis, Wilcoxon’s, Chi square, logistic regression analysis, and Spearman’s correlation) were used. Data were presented and suitable analysis was done according to the type of data (parametric and non-parametric) obtained for each variable. P-values less than 0.05 (5%) was considered to be statistically significant.

P- value: level of significance

P > 0.05: Non-significant (NS).

P < 0.05: Significant (S).

P < 0.01: Highly significant (HS).

***Descriptive statistics:***

* Mean, Standard deviation (± SD) and range for parametric numerical data, while Median and Inter-quartile range (IQR) for non-parametric numerical data.
* Frequency and percentage of non-numerical data.

***Analytical statistics:***

* Kruskal-Wallis test was used to assess the statistical significance of the difference of a non-parametric variable between more than two study groups.
* one-way ANOVA for continuous normally distributed variables. Post hoc analysis after ANOVA was performed using the Tukey test. ,with post hoc analysis by means of the Mann–Whitney U test

**3.Results:**

***Table (1):*** *Operative time and**hospital stay between the two studied groups.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Group I****(n=20)* | ***Group II*** *(n=20)* | ***T*** | ***p*** |
| ***Operative time*** *(min)**Mean ± SD* | 89.65 ± 16.42 | 96.43 ± 14.65 | 1.38 | .176 |
| ***Hospital stay*** *(days)**Mean ± SD* | 2.72 ± 0.678 | 2.32 ± 0.821 | 1.68 | .101 |

***This table shows that:***

*There is no significant difference between the two studied groups as regard operative time and hospital stay.*

***Table (2):*** *Preoperative**laboratory parameters between the two studied groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Group I****(n=20)* | ***Group II*** *(n=20)* | ***T*** | ***p*** |
| ***TC*** *(mg/dl)**Mean ± SD* | 211.47 ± 34.32 | 207.64 ± 34.29 | .353 | .726 |
| ***TG*** *(mg/dl)**Mean ± SD* | 184.56 ± 71.56 | 179.71 ± 69.21 | .218 | .829 |
| ***LDL*** *(mg/dl)**Mean ± SD* | 165.17 ± 27.42 | 153.47 ± 32.78 | 1.22 | .228 |
| ***HDL*** *(mg/dl)**Mean ± SD* | 42.35 ± 10.5 | 42.01 ± 5.11 | .131 | .897 |
| ***FBS*** *(mg/dl)**Mean ± SD* | 168.94 ± 56.22 | 172.6 ± 69.11 | .184 | .855 |
| ***HbA1c*** *(%)**Mean ± SD* | 9.54 ± 2.11  | 9.26 ± 2.24 | .407 | .686 |

*This table shows that there is no significant difference between the two studied groups regarding preoperative studied parameters.*

***Table (3):*** *3-months postoperative laboratory parameters between the two studied groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Group I****(n=20)* | ***Group II*** *(n=20)* | ***t*** | ***P*** |
| ***TC*** *(mg/dl)**Mean ± SD* | 201.65 ± 30.94 | 199.75 ± 32.83 | 1.88 | .852 |
| ***TG*** *(mg/dl)**Mean ± SD* | 179.31 ± 55.17 | 177.32 ± 35.53 | .136 | .893 |
| ***LDL*** *(mg/dl)**Mean ± SD* | 155.26 ± 24.31 | 150.39 ± 35.56 | .506 | .616 |
| ***HDL*** *(mg/dl)**Mean ± SD* | 44.07 ± 9.75 | 43.77 ± 3.65 | .129 | .898 |
| ***FBS*** *(mg/dl)**Mean ± SD* | 148.7 ± 39.6 | 153.22 ± 41.3 | .353 | .726 |
| ***HbA1c*** *(%)**Mean ± SD* | 9.14 ± 1.93 | 8.95 ± 1.38 | .358 | .722 |

**This table shows that:**

There is no significant difference between the two studied groups regarding 3 months postoperative laboratory parameters.

***Table (4):*** *6-months postoperative laboratory parameters between the two studied groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Group I****(n=20)* | ***Group II*** *(n=20)* | ***t*** | ***P*** |
| ***TC*** *(mg/dl)**Mean ± SD* | 193.24 ± 29.19 | 176.94 ± 26.51 | 1.85 | .072 |
| ***TG*** *(mg/dl)**Mean ± SD* | 169.06 ± 44.09 | 133.09 ± 30.63 | **3** | **.005** |
| ***LDL*** *(mg/dl)**Mean ± SD* | 147.94 ± 23.83 | 122.94 ± 23.99 | **3.1** | **.004** |
| ***HDL*** *(mg/dl)**Mean ± SD* | 45.25 ± 8.04 | 46.9 ± 3.23 | .852 | .400 |
| ***FBS*** *(mg/dl)**Mean ± SD* | 121.44 ± 15.39 | 105.36 ± 10.57 | **3.85** | **<0.001** |
| ***HbA1c*** *(%)**Mean ± SD* | 8.1 ± 1.67 | 6.35 ± 0.917 | **4.1** | **<0.001** |

**This table shows that:**

There is a significant difference between the two studied groups regarding TG, LDL, FBS, and HbA1c.

***Table (5):*** *12-months postoperative laboratory parameters between the two studied groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Group I****(n=20)* | ***Group II*** *(n=20)* | **T** | **P** |
| ***TC*** *(mg/dl)**Mean ± SD* | 180.27 ± 24.52 | 162.73 ± 24.34 | **2.27** | **.029** |
| ***TG*** *(mg/dl)**Mean ± SD* | 148.79 ± 33.89 | 109.53± 28.37 | **3.97** | **.001** |
| ***LDL*** *(mg/dl)**Mean ± SD* | 132.86 ± 21.98 | 98.61 ± 20.61 | 5.1 | **<0.001** |
| ***HDL*** *(mg/dl)**Mean ± SD* | 45.77 ± 5.07 | 49.74 ± 3.71 | **2.83** | **.007** |
| ***FBS*** *(mg/dl)**Mean ± SD* | 102.34 ± 11.21 | 86.22 ± 9.84 | **4.83** | **<0.001** |
| ***HbA1c*** *(%)**Mean ± SD* | 6.9 ± 1.32 | 5.82 ± 0.581 | **3.35** | **.002** |

*This table shows that there is a significant difference between the two studied groups as regard TC, TG, LDL, HDL, FBS, and HbA1c.*

***Table (6):*** *Preoperative and postoperative laboratory parameters among Group I.*

|  |  |  |
| --- | --- | --- |
|  | ***Group I*** *(n=20)* | **P#** |
| *Preoperative* | *6m postop.* | *12m postop.* |
| ***TC*** *(mg/dl)**Mean ± SD* | 211.47 ± 36.32 | 193.24 ± 29.19 | 180.27 ± 24.52 | **<0.001** |
| ***TG*** *(mg/dl)**Mean ± SD* | 184.56 ± 71.56 | 169.06 ± 44.09 | 148.79 ± 33.89 | **<0.001** |
| ***LDL*** *(mg/dl)**Mean ± SD* | 165.17 ± 27.42 | 147.94 ± 22.83 | 132.86 ± 21.98 | **<0.001** |
| ***HDL*** *(mg/dl)**Mean ± SD* | 42.35 ± 10.5 | 45.25 ± 8.04 | 45.77 ± 5.07 | .369 |
| ***FBS*** *(mg/dl)**Mean ± SD* | 168.94 ± 56.22 | 121.44 ± 12.39 | 102.34 ± 11.21 | **<0.001** |
| ***HbA1c*** *(%)**Mean ± SD* | 9.54 ± 2.11 | 8.1 ± 1.67 | 6.9 ± 1.32 | **<0.001** |

# repeated measures ANOVA.

*This table show that there a significant decrease from preoperative to 12 months postoperative regarding TC, TG, LDL, FBS, and HbA1c.*

***Table (7):*** *Pre and postoperative laboratory parameters among Group II.*

|  |  |  |
| --- | --- | --- |
|  | ***Group II*** *(n=20)* | **P#** |
| *Preoperative* | *6m postop.* | *12m postop.* |
| ***TC*** *(mg/dl)**Mean ± SD* | 207.64 ± 34.29 | 176.94 ± 26.51 | 162.73 ± 24.34 | **<0.001** |
| ***TG*** *(mg/dl)**Mean ± SD* | 179.71 ± 69.21 | 133.09 ± 30.63 | 109.53 ± 28.37 | **<0.001** |
| ***LDL*** *(mg/dl)**Mean ± SD* | 153.47 ± 32.78 | 122.94 ± 23.99 | 98.61 ± 20.61 | **<0.001** |
| ***HDL*** *(mg/dl)**Mean ± SD* | 42.01 ± 5.11 | 46.9 ± 3.23 | 49.74 ± 3.71 | **<0.001** |
| ***FBS*** *(mg/dl)**Mean ± SD* | 172.6 ± 69.11 | 105.36 ± 10.57 | 86.22 ± 9.84 | **<0.001** |
| ***HbA1c*** *(%)**Mean ± SD* | 9.26 ± 2.2 | 6.35 ± 0.917 | 5.82 ± 0.581 | **<0.001** |

# repeated measures ANOVA.

*This table show that there a significant decrease from preoperative to 12 months postoperative regarding TC, TG, LDL, FBS, and HbA1c. While there a significant increase from preoperative to postoperative follow up time intervals regarding HDL.*

***Table (8):*** *Preoperative and postoperative BMI between the two groups*

|  |  |  |
| --- | --- | --- |
| ***BMI*** *(kg/m2)* | ***Mean ± SD*** | ***P*#** |
| *Preoperative* | *3m postop.* | *6m postop.* | *12m postop.* |
| ***Group I*** | 46.83 ± 8.79 | 40.23 ± 7.54 | 35.05 ± 8.87 | 30.01 ± 7.96 | **<0.001** |
| ***Group II*** | 49.6 ± 9.11 | 42.63 ± 7.11 | 36.55 ± 6.07 | 31.22 ± 4.89 | **<0.001** |

# repeated measures ANOVA.

*This table show that there a significant decrease from preoperative to 12 months postoperative regarding BMI in both groups.*

***Table (9):*** *Early**postoperative**complications between the two studied groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Group I****(n=20)* | ***Group II*** *(n=20)* | ***χ2*** | ***P*** |
| ***Bleeding***  | 1 (5%) | 2 (10%) | .360 | .548 |
| ***Leakage*** | 1 (5%) | 2 (10%) | .360 | .548 |
| ***Ulcer*** | 0 | 1 (5%) | 1.03 | .313 |
| ***Stricture*** | 2 (10%) | 2 (10%)  | **--** | 1 |

*This table shows that there is no significant difference between the two studied groups regarding early complications.*

***Table (10):*** *Late postoperative**complications between the two studied groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Group I****(n=20)* | ***Group II*** *(n=20)* | ***χ2*** | ***P*** |
| ***Stenosis*** | 2 (10%) | 0 | 2.11 | .147 |
| ***Nausea and vomiting*** | 2 (10%) | 0 | 2.11 | .147 |
| ***Hypovitaminosis*** | 2 (10%) | 4 (20%) | .784 | .376 |
| ***Hypoalbuminemia*** | 3 (15%) | 4 (20%) | .173 | .677 |
| ***Reflux*** | 3 (15%) | 1 (5%) | 1.11 | .293 |

*This table shows that there is no significant difference between the two studied groups regarding late complications.*

**4.Discussion**

Regarding operative data we found that there was no significant difference between the two studied groups as regard operative time and hospital stay. SASI take no significantly longer operative time but associate with no significantly shorter hospital stay.

However, **Emile et al., (5)** reported that SASI bypass required longer operation time than SG (108.7 Vs 92.8 min, p < 0.0001). This disagreement may be due to the difference in sample size and inclusion criteria.

The study by **Abdalaziz et al., (6)** revealed that SASI surgery time ranged from 113 to 159 minutes, with a mean of 139.79 ±23.12. The hospital stay length ranged from 2 to 4 days, with a mean of 2.71± 0.59.

Also, **Elbanna** **et al., (7)** reported that in LSG surgery the mean operative time was 120±25.3 minutes (range, 90- 180) while the mean postoperative hospital stay was 3.2±1.5 days (range, 3-11days).

So, both our results and literature approved the superiority of SASI in terms of hospital stay period but it was associated with longer operative time.

As regard Preoperative laboratory parameters between the two studied groups, our results showed that there was no significant difference between the two studied groups regarding preoperative lipid and glycemic profiles.

This was supported by **Emile et al., (5)** who revealed that the incidence of diabetes mellitus and Dyslipidemia were comparable between groups.

In agreement with our results **Wu et al., (8)** reported that there was no significant difference between the two studied groups regarding preoperative glycemic profiles.

As regard 3-months postoperative laboratory parameters between the two studied groups, we found that there was no significant difference between the two studied groups regarding 3-months postoperative lipid and glycemic profiles.

At 6-months postoperatively, the comparison of laboratory parameters between the two studied groups showed that There is a significant difference between the two studied groups regarding TG, LDL, FBS, and HbA1c. The results indicated that SASI surgery was associated with better improvement in lipid and glycemic profiles.

Also, at 12 At 6-months postoperatively, the comparison of laboratory parameters between the two studied groups showed that There is a significant difference between the two studied groups regarding TC, TG, LDL, HDL, FBS, and HbA1c. The results indicated that SASI surgery was associated with better improvement in lipid and glycemic profiles.

Our results were supported by **Emile et al., (5)** who found that at 12 months postoperatively SASI bypass achieved significantly higher improvement in T2DM and GERD than SG (95.8% Vs 70% and 85.7% Vs 18.2%, respectively). The improvement in dyslipidemia was non significantly higher in SASI group.

Also, **Mahdy et al., (9)** reported that at 12 months postoperatively, SASI bypass was followed by a significantly higher rate of remission or improvement in T2DM compared to SG and OAGB (97.7% vs 71.4% vs 86.7%; p = 0.04). The three procedures were associated with similar improvement in hypertension (p = 0.35), hyperlipidemia (p = 0.6), sleep apnea (p = 0.99), and GERD (p = 0.72).

As well, in agreement with our results **Wu et al., (8)**  reported that After surgery, FBG levels were significantly lower in the SADI-S, SASI, and SG groups than in the SHAM group (p < 0.05). The SADI-S group showed significantly lower FBG levels than the SG group at 4, 5, and 6 months (p < 0.05).

In LSG group, comparison of preoperative and postoperative laboratory parameters, showed that there a significant decrease from preoperative to 12 months postoperative regarding TC, TG, LDL, FBS, and HbA1c.

In SASI group, comparison of preoperative and postoperative laboratory parameters, showed that there a significant decrease from preoperative to 12 months postoperative regarding TC, TG, LDL, FBS, and HbA1c. While there a significant increase from preoperative to postoperative follow up time intervals regarding HDL.

In agreement with our results **Wu et al., (8)** reported that both groups SG and SASI showed that there was significant improvement in glucose control postoperatively (p<0.05).

Our results were agreed with **Emile et al., (5)** who revealed that there was a significant improvement in comorbidities in SASI and SG group.

Similarly, **Mahdy et al., (9)** revealed that there was a significant improvement in comorbidities in Sleeve Gastrectomy, One-Anastomosis Gastric Bypass (OAGB), and Single Anastomosis Sleeve Ileal (SASI) groups.

A systematic review and meta-analysis by **Emile et al., (10)** including 941 patients underwent SASI bypass showed that the weighted mean rate of improvement in diabetes mellitus was 99.1 (95%CI: 98.2–99.9, I2 = 0). The crude percentages of patients with improvement in hypertension, hyperlipidemia, and gastroesophageal reflux disease were 51%, 76.6%, and 92%, respectively.

Also, **Abdalaziz et al., (6)** reported that patients’ evaluation at the 1-year post SASI procedure revealed that there were statistically high significant differences in the HbA1C, total cholesterol and triglycerides levels compared to the baseline measures, while no significant difference was noted in the serum albumin levels. The remission rates of T2DM, hyperlipidemia, and hypertension were 85.7%, 94.7%, and 89.66%, respectively, with statistically high significant differences between the pre-operative and 1-year post-operative comorbidities rate.

As well, in agreement with the current study **Deabes et al., (11)** revealed that there was high significant difference between before and after SASI surgery as regard FBG, HbAIC, triglycerides, cholesterol, HDL and LDL.

Comparison of preoperative and postoperative BMI in the two groups, showed that there was significant decrease from preoperative to 12 months postoperative regarding BMI in both groups.

This was supported by **Emile et al., (5)** who revealed that both groups showed a significant decrease in body weight and BMI at 6 and 12 months postoperatively. There no were no significant differences between SG and SASI bypass in weight loss at 6 months after surgery. However, the differences between the two groups in body weight and BMI at 12 months were statistically significant. Similarly, while the %EWL at 6 months postoperatively was similar between SG and SASI bypass, SASI bypass conferred significantly higher %EWL at 12 months as compared to SG (72.6 ± 14.03 Vs 60.4 ± 12.5, p < 0.0001).

Also, **Mahdy et al., (9)** reported that a significant weight loss was recorded at 6 and 12 months after the three procedures [Sleeve Gastrectomy, One-Anastomosis Gastric Bypass (OAGB), and Single Anastomosis Sleeve Ileal (SASI)] as revealed by a significant decrease in weight and BMI compared to baseline values and a significant increase in %TWL, %EWL, and %EBMIL. At 6 months postoperatively, body weight and BMI were significantly lower after SASI bypass than after SG and OAGB (p = 0.01 & 0.04). The %TWL, %EWL, and %EBMIL were significantly higher after SASI bypass than after SG and OAGB (p = 0.0001, < 0.0001, 0.02). Similarly, at 12 months postoperatively, body weight and BMI were significantly lower after SASI bypass than after SG and OAGB (p < 0.0001). The %TWL and %EWL were significantly higher after SASI bypass than after SG and OAGB (p < 0.0001 each) whereas the %EBMIL was comparable among the three groups (p = 0.059).

Furthermore, **Wu et al., (8)** revealed that there was no significant difference in body weight and food intake among all the groups preoperatively. Postoperatively, food intake was significantly lower in the SADIS, SASI, and SG groups than in the SHAM group (p <0.05). Body weight was significantly lower in the SADI-S, SASI, and SG groups than in the SHAM group (p < 0.05). The SADI-S and SASI groups showed significantly lower body weight than the SG group at 3 and 4 months (p < 0.05).

The systematic review and meta-analysis by **Emile et al., (10)** in SASI bypass showed that the median BMI of 45.6 kg/m2. The median %EWL at 6 months was 59.4% and significantly (p = 0.04) increased to 90.1% at 12 months.

Furthermore, **Moustafa** **et al., (12)** reported that there was a significant BMI reduction in SASI and mini-gastric bypass groups at 1, 6 and 12 months of the follow-up. The mean BMI values were significantly lower in the SASI group compared to mini-gastric bypass group 2 during the whole follow-up, but the differences in %EWL were not significant.

Also, **Abdalaziz et al., (6)** reported that patients’ evaluation at the 1-year post SASI procedure revealed that the weight and BMI decreased significantly with mean difference of 47.21 ± 6.17 and 18.17 ± 3.43, respectively. The %TWL mean was 37.55 ± 6.17 and the mean %EBWL was 76.21 ± 9.8.

Regarding early postoperative complications between the two studied, our results showed that there was no significant difference between the two studied groups regarding early complications.

Also, as regard late postoperative complications between the two studied groups, we found that there was no significant difference between the two studied groups regarding late complications.

Our results were agreed with **Emile et al., (5)** who found that there was no significant difference between the two studied groups regarding early complications. Twelve (20.7%) complications were recorded after SG and four (6.9%) complications after SASI bypass (p = 0.056). Complications of SG included de-novo GERD (n = 7), staple line leak (n = 1), persistent vomiting (n = 2), bleeding (n = 1), post site hematoma (n = 1). Complications of SASI bypass included bleeding (n = 1), bowel obstruction (n = 1), and pneumonia (n = 2).

However, **Mahdy et al., (9)** reported that Short-term complications occurred in one patient after OAGB in the form of pouch gangrene and perforation and in three patients after SASI bypass in the form of bleeding and obstruction whereas no short-term complications were recorded after SG. SASI bypass had the highest rate of short-term complications; however, the difference between the three procedures was not statistically significant (0 vs 1 vs 4% in SG, OAGB, SASI bypass respectively, p = 0.07). Long-term complications involved hypoalbuminemia in two patients who underwent SG, nine patients who underwent OAGB, and nine patients who had SASI bypass. Two patients developed peripheral neuropathy after SASI bypass due to vitamin deficiency. There was a significant difference between the three procedures in terms of long-term complications (2% vs 9.8% vs 14.9%, p = 0.005). the disagreement regarding the long-term complications may be due to the difference in sample size and the significant difference in ages between the three studied groups.

The systematic review and meta-analysis by **Emile et al., (10)** in SASI bypass showed that the complications were recorded in 116 (12.3%) patients.

**5.Conclusion:**

Both SASI and LSG procedures were safe and effective in the treatment of morbid obese. Both procedures resulted in significant improvement in BMI, lipid and glycemic profiles. SASI procedure results in better outcome as regard the improvement in both lipid and glycemic profiles, but it was comparable with LSG as regard operative data and rate of early and late complications. Further comparative studies with larger sample size and longer follow-up are needed to confirm our results and to identify risk factors of adverse events.

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