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Sleeve Gastrectomy Versus Mini-gastric Bypass in Type 2 Diabetes

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Abstract

Obesity is a major health burden worldwide.A variety of surgical procedures are available, and currently, it is difficult to identify the most effective option based on patient characteristics and comorbidities. This study aimed to compare the results of sleeve gastrectomy and mini-gastric bypass on type 2 diabetic morbid obese patient. Sixty morbidly obese patients thirty for sleeve gastrectomy and thirty for minigastric bypasse.g., BMI >40 kg/m2 or >35 kg/m2 with associated comorbidity with failed diet for more than two years will be included in this study for12months. mean operative time of group A [sleeve gastrectomy] was 110 minute while the mean operative time of group B [minigastric bypass] was 119 minutes. The difference between operative time in both groups was statistically significant.there was statistically significant decrease in BMI at 12 months among Mini-gastric Bypass group than Sleeve Gastrectomy group. there was statistically significant decrease in HbA1c 12 months and Total HbA1c change among Group B than Group A. In present study, there was no statistically significant difference between Group A and Group B regarding complications except statistically significant decrease in Dumping and Symptomatic cholelithiasis [conserve] among Group A than Group B. Sleeve gastrectomy has shorter operative time than mini-gastric bypass. both procedures have near same effect on loss of weight and resolving or better control on co-morbidities as DM.There was no statistically significant difference between Sleeve gastrectomy and mini-gastric bypass group regarding complications.

Keywords: Sleeve Gastrectomy, Mini-gastric Bypass, Type 2 Diabetes mellitus.

1.Introduction

According to the International Diabetes Federation [IDF] Diabetes Atlas [sixth edition], in 2013, 382 million people had diabetes worldwide and the prevalence is expected to increase to 592 million by 2035. Obesity is a strong risk factor for T2DM, and so reducing body weight is the most effective treatment for T2DM. Metabolic disease, such as T2DM can be treated by metabolic surgery, via digestive surgery, which is similar to bariatric surgery [1].

Obesity is a major health burden worldwide, and although it was considered a disease of the western world, it seems to have expanded to the developing world. Severe obesity is one of the major problems in the world and is associated with several comorbidities [e.g. cardiovascular disease, metabolic syndrome, type 2 diabetes mellitus [T2DM], infertility, and increased mortality]. Significant obstructive sleep apnea [OSA] is present in 40% of obese persons and venous thromboembolism in 12% [2].

More than 70% of patients with sleep apnea present with obesity. Conservative measures, such as dieting and physical exercise, have proven inadequate [3]

There is considerable evidence in the literature on the long-term positive effect of bariatric surgery as a primary therapy for the treatment of obesity and its comorbidities. Significant debate remains as to which patients are optimal candidates for which procedures. Depending on the type of operation, gastrointestinal surgery is also very effective in the resolution of diabetes [4].

Traditionally, the primary mechanisms through which bariatric surgery achieves its outcomes are believed to be the mechanical restriction of food intake, reduction in the absorption of ingested foods, or a combination of both [5].

A variety of surgical procedures are available, and currently, it is difficult to identify the most effective option based on patient characteristics and comorbidities. Furthermore, little is known regarding the effect of the various surgical procedures on glycemic control and T2DM remission [6].

Laparoscopic sleeve gastrectomy [LSG] is a restrictive approach used commonly in bariatric practice. SG was first described in 1999 as part of the biliopancreatic diversion duodenal switch procedure. Subsequently, LSG has been performed as a standalone procedure [7].

Although these procedures have proven to be good therapeutic options for some patients, it is not without significant complications, such as gastric leaks, which pose a particularly difficult challenge when they occur near the angle of His, potentially generating severe clinical conditions that require reoperation, and may even cause death [8].

Mini-gastric bypass [MGBP], first reported by Rutledge, was proposed as a simple and effective treatment of morbid obesity. MGBP is a modification of the Mason's loop gastric bypass, with weight loss results similar to laparoscopic Roux-en-Y gastric bypass [LRYGB], which was the most favored bariatric procedure in America. This procedure has also been called one or single anastomosis gastric bypass [9].

This study aimed to compare the results of sleeve gastrectomy and mini-gastric bypass on type 2 diabetic morbid obese patient.

2.Patients and Methods

Sixty morbidly obese patients who fulfilled the criteria for bariatric surgery thirty for sleeve gastrectomy and thirty for minigastric bypasse.g., BMI >40 kg/m2 or >35 kg/m2 with associated comorbidity with failed diet for more than two years will be included in this study for 12 months. These patients were enrolled in Benha University Hospitals and hospitals of ministry of health.

2.1 Inclusion criteria

BMI more than 40 kg/m2.Less severely obese patients [BMIs between 35 and 40 kg/m2] were considered for surgery if they had comorbidities such as diabetes type II, hypertension and sleep apnea syndrome.History of failure of non surgical treatment for more than two years.

2.2 Exclusion criteria

Patients with previous open upper abdominal surgery, underwent previous obesity surgery, psychologically refuse surgery and history of gastric ulcer disease.

The documented preoperative, operative and postoperative follow up data for all patients were collected and reviewed and the outcome of surgery were evaluated.

Patients were subjected to preoperative assessment which included:

1- Age and gender.

2- Full clinical assessment:

a] Full medical history with special notes on:

History of attempts to lose weight for more than two years. Detailed dietary history. Associated comorbidities. Weight loss trials. Eating habits.Psychological status.History of previous laparotomy especially gastrointestinal surgery.

3- Full clinical examination including BMI

4- Full laboratory investigations:

Complete blood picture, Liver function tests, kidney function tests, Lipid profile, Thyroid profile, Hemoglobin A1C,Glucose tolerance test. Patient was described as diabetic if fasting blood sugar will be126 mg/dl or above or two hours postprandial blood sugar will be 200 mg/dl or above or random blood sugar will be 200 mg/dl or above.

5- Pulmonary function test.

6- Radiological imaging:Plain X-Ray chest, pelvi abdominal ultrasonography.

Each patient was routinely thoroughly evaluated by a multidisciplinary team [nutritionist, endocrinologist, psychologist, and surgeon]. Surgeries were done by the same surgical team throughout the study.

2.3 Post operative follow up

The follow up was carried out on an outpatient basis:

- Weekly visit for one month after discharge from the hospital,
- Monthly visit till the end of the third month.

§ In each visit patient will have:

- Full clinical assessment,
- Measurement of the weight& BMI,
- Required investigations according to the patient‘s condition.

2.4 Post operative diet regimen

Patients were instructed to follow up five stages diet regimen under supervision of the nutritionists as follow:

- **The first stage** was started when the patient started oral fluids in the form of clear fluids for five days,
- **The second stage** was started in the second week post operatively for three weeks in the form of protein rich fluids,
- **The third stage** was started in the second month post operatively for one month in the form of smashed diet,
- **The fourth stage** was started in the third month post operatively for one month in the form of low calorie soft diet,
- **The fifth stage** was started in the fourth month post operatively in the form of low fat low sugar small frequent meals.

2.5 Post operative drug therapy

- **On discharge,** patients were instructed to receive oral treatment in the form of broad spectrum antibiotic, analgesic and proton pump inhibitor for one week,
- **In the second stage,** patients continued to receive the proton pump inhibitor and started to receive intramuscular vitamin B12.
- **In the third stage,** patients were stopped the proton pump inhibitor and continued the rest of the drugs and started to receive oral calcium together with vitamin D,
- **In the fourth stage,** patients were continued on the same treatment and were started to receive oral iron supplement to continue on that treatment for the next three months.

2.6 Data collection

Standardized data collection were performed which included:

2.6.1 Preoperative data

- Age,
- Sex,
- Type of eating [sweet eater or not],
- Comorbidities,
- Family history of obesity,
- Med

2.6.2 History

- History of previous abdominal surgery,
- Height,
- Weight,
- BMI.

2.6.3 Operative data

- Operative time which was defined as the time from the first incision to the placement of the last suture,
- Intraoperative complications,
- Conversion to open procedure.

2.6.4 Postoperative care data

- Intensive care unit admission,
- Postoperative pain,
- Hospital stay which was defined as the number of days in the hospital after surgery inclusive of the day of surgery.

2.6.5 Follow up data

- Follow up weight,
- Follow up of excess weight loss,
- Follow up BMI,
- Postoperative complications
- Follow up of eating habits
- Follow up of comorbidities.

2.7 Statistical Analysis

The data were coded, entered and processed on computer using *SPSS* [version 18]. The results were represented in tabular and diagrammatic forms then interpreted. Mean, standard deviation, range, frequency, and percentage were use as descriptive statistics. The following test was done: Chi-Square testX^2 was used to test the association variables for categorical data. Student's t-test was used to assess the statistical significance of the difference between two population means in a study involving independent samples. P value was considered significant ≤ 0.05: Significant.

3.Results

There was no statistically significant difference between Group A and Group B regarding Age, sex and Family history Table (1).

There was no statistically significant difference between Group A and Group B regarding BMI baseline, BMI 3 months and BMI 6 months.There was statistically significant decrease in BMI 12 months among Group B than Group A. There was statistically significant decrease in Total BMI loss among Group B than Group A. Table (2).

There was no statistically significant difference between Group A and Group B regarding FBS baseline, FBS 3 months, FBS 6 months and FBS 12 months.There was statistically significant decrease in Total FBS change among Group B than Group A. Table (3).

There was no statistically significant difference between Group A and Group B regarding HbA1c baseline, HbA1c 3 months and HbA1c 6 months.There was statistically significant decrease in HbA1c 12 months and Total HbA1c change among Group B than Group A. Table (4).

There was statistically significant decrease in Operative time [min] among Group A than Group B. Table (5).

There was no statistically significant difference between Group A and Group B regarding Bleeding [no exploration], Wound infection [SSI]], Nausea and vomiting, Venous thrombotic event , Bleeding [exploration], Symptomatic reflux, Vitamins and mineral deficiency, Port site hernia and Symptomatic cholelithiasis [surgery.There was statistically significant difference between Group A and Group B regarding Dumping and Symptomatic cholelithiasis [conserve] Table (6).

Table (1) Comparison between Group A [Sleeve Gastrectomy] and Group B [Mini-gastric Bypass] regarding demographic data.

			Group A [Sleeve [Gastrectomy [[No.= 30	Group B [Mini- [gastric Bypass [No.= 30]	t.test	P. value
Age	Mean ± SD		48.67 ± 8.29	46.87 ± 8.34	.838	0.405
sex	female	No.	22	22	X^2 .000	1.000
		%	73.3%	73.3%		
	male	No.	8	8		
		%	26.7%	26.7%		
Family history	atherosclerosis	No.	2	0	X^2 7.378	0.117
		%	6.7%	.0%		
	diabetes	No.	2	8		
		%	6.7%	26.7%		
	hypertension	No.	4	2		
		%	13.3%	6.7%		
	hypertriglecerdemia	No.	2	4		
		%	6.7%	13.3%		
	negative	No.	20	16		
		%	66.7%	53.3%		

Table (2) Comparison between Group A [Sleeve Gastrectomy] and Group B [Mini-gastric Bypass] regarding BMI baseline, BMI 3 months, BMI 6 months, BMI 12 months and Total BMI loss.

		Group A [Sleeve [Gastrectomy [[No.= 30	Group B [Mini- [gastric Bypass [No.= 30]	t.test	P. value
BMI baseline	Mean ± SD	52.16 ± 11.56	55.71 ± 8.67	-1.346-	0.184
BMI 3 months	Mean ± SD	46.95 ± 9.14	48.68 ± 8.89	-.744-	0.46
BMI 6 months	Mean ± SD	42.34 ± 8.45	43.32 ± 7.73	-.470-	0.64
BMI 12 months	Mean ± SD	38.72 ± 8.42	33.33 ± 10.25	2.224	0.03
Total BMI loss	Mean ± SD	12.89 ± 7.92	19.98 ± 4.14	-4.346-	0.00

Table (3) Comparison between Group A [Sleeve Gastrectomy] and Group B [Mini-gastric Bypass] regarding FBS baseline, FBS 3 months, FBS 6 months, FBS 12 months and Total FBS change.

		Group A [Sleeve [Gastrectomy [[No.= 30	Group B [Mini- [gastric Bypass [No.= 30]	t.test	P. value
FBS baseline	**Mean ± SD**	145 ± 14.74	149.80 ± 12.56	1.435	0.157
FBS 3 months	**Mean ± SD**	149.20 ± 44.74	154.60 ± 29.34	-.553-	0.583
FBS 6 months	**Mean ± SD**	137.73 ± 40.66	133.66 ± 21.77	.483	0.631
FBS 12 months	**Mean ± SD**	127.27 ± 35.96	124.40 ± 27.26	.348	0.729
Total FBS change	**Mean ± SD**	43.40 ± 15.59	52.40 ± 16.98	-2.138-	0.037

Table (4) Comparison between Group A [Sleeve Gastrectomy] and Group B [Mini-gastric Bypass] regarding HbA1c baseline, HbA1c 3 months, HbA1c 6 months, HbA1c 12 months and Total HbA1c change.

		Group A [Sleeve [Gastrectomy [[No.= 30	Group B [Mini- [gastric Bypass [No.= 30]	t.test	P. value
HbA1c baseline	Mean ± SD	8.325 ± 1.178	8.179 ± 2.50	-3.670-	0.421
HbA1c 3 months	Mean ± SD	7.447 ± .97	7.74 ± .889	-1.234-	0.222
HbA1c 6 months	Mean ± SD	7.02 ± 1.017	6.92 ± .88	.406	0.686
HbA1c 12 months	Mean ± SD	6.43 ± .98	6.53 ± 1.177	-.353-	0.026
Total HbA1c change	Mean ± SD	1.627 ± .82	3.09 ± 1.33	-5.137-	0.000

Table (5) Comparison between Group A [Sleeve Gastrectomy] and Group B [Mini-gastric Bypass] regarding Operative time [min].

		Group A [Sleeve [Gastrectomy [[No.= 30	Group B [Mini- [gastric Bypass [No.= 30]	t.test	P. value
Operative [time]min	Mean ± SD	110± 6.89	119 ± 7.10	3.896	0.000

Table (6) Comparison between Group A [Sleeve Gastrectomy] and Group B [Mini-gastric Bypass] regarding development of complications.

				Group A [Sleeve [Gastrectom [No.=30]	Group B [Mini-gastric [Bypass [No.=30]	X^2	P. value
Early	**Minor**	Bleeding [no [exploration	No. %	3 10%	1 3.33 %	1.8	0.61
		[Wound infection [SSI]	No. %	1 3.33 %	2 6.66%	2.5	0.81
		Nausea and vomiting	No. %	0 0%	2 6.66%	1.4	0.51

Table (6) Continue

	Major	Venous thrombotic event	No. %	0 0%	1 3.33 %	2.5	0.81
		[Bleeding [exploration	No. %	3 10%	0 0%	.9	0.06
Late	**Minor**	Dumping	No. %	5 16.66 %	16 53.33	23.5	0.00
		Symptomatic cholelithiasis [[conserve	No. %	0 0%	6 20%	3.5	0.04
		Symptomatic reflux	No. %	5 16.66 %	7 23.33 %	1.8	0.61
		Vitamins and mineral deficiency	No. %	3 10%	2 6.66%	2.5	0.81
	Major	Port site hernia	No. %	3 10%	2 6.66%	2.5	0.81
		Symptomatic cholelithiasis [surgery	No. %	3 10%	1 3.33 %	1.8	0.61

4.

Discussion

This study has been conducted sixty morbidly obese patients were classified into Group A [30] [Sleeve Gastrectomy] and [30] Group B [Mini-gastric Bypass].

This present study, there was no statistically significant difference between Group A and Group B regarding Age, sex and Family history and c. peptide [P>0.05].

This study showed, the mean operative time of group A [sleeve gastrectomy] was 110 minute while the mean operative time of group B [minigastric bypass] was 119 minutes. The difference between operative time in both groups was statistically significant.

This disagree with A. Plamper et al., [10] who reported in their study comparing SG with MGBP that duration of the operation showed to be significantly shorter for MGB.

This agree with **[11]** who found that the mean operative time for LSG was significantly shorter than that for LRYGB [*P* = 0.003].

Compared to the published results, in the study of M. Musella et al., [12] [to compare between gastric balloon, LAGB, LSG and LMGB] the mean operative time with LSG was 75 ± 15.3 minutes while with LMGB mean operative time was 115 ± 15.6 minutes**.**

And in the study done by W.J. Lee et al., [13] [which compare between LMGB and LRYGB], the mean operative time with LMGB was 115.3 minutes**.** While in the study done by P. Gentileschi et al., [14], the mean operative time with LSGB was 58.5 minutes**.**

In the present study, there was statistically significant decrease in BMI at 12 months among Mini-gastric Bypass group than Sleeve Gastrectomy group.

This agrees with E.A. Mostafa et al., [15] who aimed to compare SG with MGBP for the management of morbid obesity and its comorbidities. It was done from October 2016 to July 2018. Patients were chosen and divided randomly into two groups in accordance to their admission to the study: the first group underwent LSG, whereas the second group underwent laparoscopic MGBP. They found there was statistically significant decrease in BMI at 12 months among Mini-gastric Bypass group than Sleeve Gastrectomy group.

This agrees also with A. Plamper et al., [10] who noticed that MGB cases weight loss greater than SG cases after one year. %EWL was 66.2% [±13.9%] in MGB versus 57.3% [±19.0%] in SG [P-value is < 0.0001]. BMI was 34.9 kg/m2 [± 4.8 kg/m2] in MGB versus 38.5 kg/m2 [± 8.6 kg/m2] in SG [P-value is 0.001].

C. Boza et al., [16] have reported excellent results of 1000 consecutive LSG procedures with a mean EWL of 84.5% at 3-year follow-up and with minimal weight regain after the first postoperative year.

Our study showed, there was statistically significant decrease in Total FBS change among [Sleeve Gastrectomy] than Group B [Mini-gastric Bypass] [P-value was < 0.05].

M.M.Abdel-Rahim et al., [17] found, fasting blood sugar was better in LMGB group than in LSG group P-value was 0.000]highly significant].

In present study, there was statistically significant decrease in HbA1c 12 months and Total HbA1c change among Group B than Group A.

W.J. Lee et al., [13**]** including 62 T2DM obese patients underwent gastrointestinal surgery [LGB, LMGB and LSG]. After one year the result was remission of T2DM achieved in 45 [72.5%] patients after these different operations. A comparison among three different operative methods revealed remission rate of T2DM was achieved in 84.8%, 58.8% and 58.3% of patients

for LMGB, LAGB and LSG, respectively. LMGB had the best remission effect on T2DM [85%] at 1 year after surgery compared with LAGB and LSG. Among the different operative methods, waist circumference and C-peptide levels were determined to be significant predictors for the remission of T2DM in obese patients**.** The result of our study agreed with this study as regard that both operation are effective in diabetes remission but MGB has better effect than SG.

Our results are dissimilar to other studies, in a double-blind randomized trial included 60 participants done by J.M. Lee et al., [18], comparing the efficacy of diabetic control and the role of duodenal exclusion in mildly obese diabetic patients undergoing LSG and LMGB, followed up for 5 years, it was founded that LSG and LMGB have the weight loss [LMGB; 22.8 ± 5.9 vs. LSG; 20.1 ± 5.3%; P-value is >0.05] but LMGB decreases HbA1c better than LSG [LMGB; 6.1 ± 0.7 vs. LSG; 7.1 ±1.2%; P-value is <0.05].

In a retrospective study done by M. Musella et al.,[12], to define the efficacy of both mini gastric bypass and sleeve gastrectomy in T2DM remission in morbidly obese patients, 63.7% of 313 patients reached one year follow up. The mean BMI for MGB cases was 33.1 ± 6.6, and the mean BMI for SG cases was 35.9 ±5.9 [P-value is < 0.001]. 85.4% of MGB cases vs. 60.9% of SG cases were in remission [P-value is < 0.001]. The % change vs. baseline values for HbA1c and FBS was not related to BMI reduction for both operations. In a comparison of mini-gastric bypass with sleeve gastrectomy in mainly super-obese patients.

This study showed, there was no statistically significant difference between Group A and Group B regarding hospital stay.In SG group the mean was 2.13 days while in MGB group, hospital stay mean was 2.93 days.

This disagrees with T.M. Sherif et al., [11] found that the mean hospital stay was shorter in the LSG group than in the LRYGB group [5 vs. 6 days].

In the study done by P. Gentileschi et al., [14], the mean postoperative hospital stay after LSG was 3.2 days**.** While in another study done by M. Musella et al., [12], the mean postoperative hospital stay was 4 days**.**

In present study, there was no statistically significant difference between Group A and Group B regarding Bleeding [no exploration], Wound infection [SSI]], Nausea and vomiting, Venous thrombotic event , Bleeding [exploration], Symptomatic reflux, Vitamins and mineral deficiency, Port site hernia and Symptomatic cholelithiasis [surgery]. There was statistically significant decrease in Dumping and Symptomatic cholelithiasis [conserve] among Group A than Group B.

This agrees with randomized trials done by P.R. Schauer et al., [19] on 150 obese patients with uncontrolled type 2 diabetes to receive either intensive medical therapy alone or intensive medical therapy plus Roux-en-Y gastric bypass or sleeve gastrectomy, bariatric surgery has been associated with improvement in type 2 diabetes mellitus. The primary end point was a glycated hemoglobin level of 6.0% or less. At 3 years, the criterion for the primary end point was met by 5% of the patients in the medical-therapy group, as compared with 38% of those in the gastric-bypass group [P<0.001] and 24% of those in the sleeve-gastrectomy group [P = 0.01]. The use of glucose-lowering medications, including insulin, was lower in the surgical groups than in the medical-therapy group. There were no major late surgical complications**.**

A.A. Gumbs et al., [20] reported incidence of complication among 646 patients underwent SG. Leakage rate [0.9%], stricture [0.7%], bleeding [0.3%], wound infection [0.1%], trocar site hernia [0.1%], conversion [0.1%] and mortality [0.6%]**.**

5.Conclusion

Sleeve gastrectomy has shorter operative time than mini-gastric bypass.After prospectively comparing the two procedures for a year, almost both procedures have near same effect on loss of weight and resolving or better control on co-morbidities as DM.There was no statistically significant difference between Sleeve gastrectomy and mini-gastric bypass group regarding complications.

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