

Comparative Study between the Complications of Sleeve Gastrectomy versus the Complications of Gastric Bypass

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ABSTRACT

Background: obesity means having too much body fat. Causes of obesity includes: diet, sugar overload, genetics, insufficient sleep, social determinants, environment, and stress. Complications of obesity includes: type II diabetes mellitus, heart diseases, metabolic syndrome, hyperlipidemia, respiratory diseases, male sexual dysfunction, neurological diseases, gastrointestinal diseases, rheumatic diseases, urological diseases, psychological abnormalities, trauma, pancreatic diseases, gall bladder diseases, diverticulitis and hernia. Sleeve gastrectomy is an excellent procedure for management of morbid obesity. Complications of Sleeve gastrectomy includes: Hemorrhage, leakage, nutritional deficiencies, ineffective EWL and weight regain, cholelithiasis, stenosis, gastroesophageal reflux disease GERD and hiatus hernia, gastric torsion, gastro-bronchial fistula and venous thrombosis. Complications with Roux-en-Y Gastric Bypass includes: Hemorrhage, leakage, nutritional deficiencies, ineffective excess weight loss EWL and weight regain, trocar site hernia, cholelithiasis, dumping syndrome, Internal hernia, obstruction of the biliopancreatic limb, intussusceptions volvulus, gastrogastic fistula, marginal ulceration and gastrojejunostomy anastomotic stricture.

Aim: To compare complications associated with Sleeve Gastrectomy versus complications associated with open or laparoscopic Gastric Bypass and its effects on patients' life and to know which procedure is better.

Patients and Methods: group (A): includes 15 cases underwent sleeve gastrectomy. With inclusion criteria of obese patients with body mass index (BMI) ≥ 40 kg/m² or BMI ≥ 35 kg/m² with associated co morbidity (hypertension, Diabetes mellitus, hyperlipidemia, arthritis, cardiac diseases, etc.) and exclusion criteria of patients with previous bariatric surgery, previous upper gastrointestinal surgery, hiatus hernias, heavy sweet eaters, drug and/or alcohol addiction, psychiatric disorders and patients >60 years old or <18 years old were excluded and group (B): includes 15 cases underwent gastric bypass with inclusion criteria of obese patients with body mass index (BMI) >40 kg/m² or BMI > 35 kg/m² with associated comorbidity (hypertension, Diabetes mellitus, hyperlipidemia, arthritis, cardiac diseases, etc.) and heavy sweet eaters and exclusion criteria of patients with previous bariatric surgery, previous upper gastrointestinal surgery apart from laparoscopic cholecystectomy. Patients with hiatus hernias, drug and/or alcohol addiction, psychiatric disorders and patients >60 years old or <18 years old were excluded.

Results: three complications developed with sleeve gastrectomy 20% as follows 1 case of hemorrhage 6.6% , 1 case of leakage 66% and one case of gall bladder stones while gastric bypass complications resembles 2 cases 13.3% as follows: 1 case of deep venous thrombosis 6.6% and one case of gall bladder stones 6.6%.

Conclusion: obesity is a common disease affecting more than 300 million adults worldwide. It is defined as a body mass index greater than 30 kg/m². The laparoscopic sleeve gastrectomy was adopted as a primary procedure and over time it has become the most popular bariatric operation worldwide and it is effective for weight loss and results in improvement and even resolution of co-morbidities like type 2 diabetes. Laparoscopic gastric bypass surgery is another safe and simple surgical intervention for treating morbid obesity and diabetes mellitus and is now being performed more frequently

Recommendations: both sleeve gastrectomy SG and roux-en-y gastric bypass RYGB are safe, short, simple and effective bariatric operations. Our study showed Roux-en-y gastric bypass has less complication than Sleeve gastrectomy. Further prospective studies have to be applied to a larger number of patients for longer periods of follow up are needed.

Keywords: Obesity- Sleeve Gastrectomy- Roux-En-Y Gastric Bypass.

INTRODUCTION

Obesity means having too much body fat. It is different from being overweight, which means weighing too much. The weight may come from muscle, bone, fat, and/or body water. Both terms

mean that a person's weight is greater than what's considered healthy for his or her height ⁽¹⁾.

Being obese increases risk of diabetes, heart disease, stroke, arthritis, and some cancers. If you are obese, losing even 5 to 10 percent of your weight

can delay or prevent some of these diseases. For example, that means losing 10 to 20 pounds if you weigh 200 pounds ⁽¹⁾.

Sleeve gastrectomy is an excellent procedure for the surgical management of morbid obesity. Expected weight loss at 6 and 12 months averages 49% and 56%, respectively. Improvement in comorbidities of obesity, such as hypertension and diabetes mellitus, has been reported to occur in the majority of patients with resolution in 60-100% ⁽²⁾.

The complications of sleeve gastrectomy includes: hemorrhage, leak, deep vein thrombosis, pulmonary embolus and abscess stricture, nutrient deficiency, Gastro-esophageal reflux disease (GERD) and gastric sleeve dilatation. The risk of postoperative bleeding has been reported to be between 1% and 6% after laparoscopic sleeve gastrectomy (LSG). The source of bleeding can be intra- or extra luminal. Intra luminal bleeding from the staple line usually presents with an upper gastrointestinal bleed. Extra luminal bleeding include the gastric staple line, spleen, liver or abdominal wall at the sites of trocar entry ⁽³⁾.

Laparoscopic Gastric Bypass is a mixed restrictive and malabsorptive bariatric surgery. Complications including marginal ulcers, chronic alkaline reflux, Barrett's esophagus, anastomosis leakage, and stenosis requiring revisional surgery made it less popular; however, it also has some advantages, such as one less anastomosis, shorter operative time, lower risk of anastomotic leakage and internal herniation, shorter learning curve, and the ease of reversibility. ⁽⁴⁾

AIM OF THE WORK

To compare complications associated with Sleeve Gastrectomy either open or laparoscopic versus complications associated with open or laparoscopic Gastric Bypass and its effects on patients' life and to know which procedure is better as regard avoiding complications as possible.

PATIENTS AND METHODS

This comparative prospective study was conducted in Al- Hoseen and Said Galal University hospitals.

The study groups were selected from the Surgery department inpatients, the study was on patients suffering from morbid obesity. They were diagnosed as morbidly obese according to **BMI** of more than 40 kg/m² with or without obesity related

comorbidities or with **BMI** of more than 35 Kg/m² with obesity related comorbidities and had suffering at least 5 years of morbid obesity and all of them had failed trials of conservative management.

Target population:

Group (A): includes 15 cases underwent sleeve gastrectomy.

Inclusion criteria:

Included obese patients with body mass index (**BMI**) ≥ 40 kg/m² or **BMI** ≥ 35 kg/m² with associated comorbidity (hypertension, Diabetes mellitus, hyperlipidemia, arthritis, cardiac diseases, etc.).

Exclusion criteria:

Included patients with previous bariatric surgery, previous upper gastrointestinal surgery (open or laparoscopic) apart from laparoscopic cholecystectomy. Patients with hiatus hernias, heavy sweet eaters, drug and/or alcohol addiction, psychiatric disorders and patients >60 years old or <18 years old were excluded.

Group (B): includes 15 cases underwent gastric bypass.

Inclusion criteria:

Obese patients with body mass index (**BMI**) >40 kg/m² or **BMI** > 35 kg/m² with associated comorbidity (hypertension, Diabetes mellitus, hyperlipidemia, arthritis, cardiac diseases, etc.) and heavy sweet eaters.

Exclusion criteria:

Included patients with previous bariatric surgery, previous upper gastrointestinal surgery (open or laparoscopic) apart from laparoscopic cholecystectomy. Patients with hiatus hernias, drug and/or alcohol addiction, psychiatric disorders and patients >60 years old or <18 years old were excluded.

All patients were subjected basically to the following:

1. Written informed consent:

It was obtained from each patient, including explanation of the procedure, description of the technique, the possible side effects and outcome which may be favorable or not.

2. All patients had failed trials of conservative weight reduction in the form of life style

changes (increase exercise, medically supervised diet control) and drug therapy to decrease weight.

3. Full **history** taking with particular attention to:
 - a) Age of patients.
 - b) Duration of obesity.
 - c) History of medications, steroid treatment, hormonal therapy.
 - d) History of previous diseases (diabetes mellitus, hypertension, bronchial asthma, obstructive sleep apnea, ischemic heart disease, peripheral vascular disease, liver disease, osteoarthritis and degenerative joint disease.
 - e) Past history of surgical operations especially abdominal operations or history of blood transfusion.
 - f) Nutritional counseling.
 - g) Psychiatric counseling.
 - h) History of smoking or drug abuse.
4. Full clinical examination including pattern of obesity and weight, BMI measurement.
5. Preoperative investigations in the form of:
 - i. Complete blood count.

- ii. Lipid profile, blood cholesterol and triglyceride assay.
- iii. Liver and kidney functions tests.
- iv. Blood glucose level.
- v. Hormonal assay in selected patients (Cushing's disease or myxedema).
- vi. Pulmonary function tests.
- vii. Chest x-ray.
- viii. Electrocardiogram.
- ix. Abdominal ultrasound.

RESULTS

This combined retrospective and prospective comparative study was done at Alhosen and Said Galal hospitals, Al-Azhar University. It included 30 obese patients, divided into two groups; group **A**: sleeve gastrectomy (**SG**) and group **B**: gastric bypass (**RYGB**). Group (**A**) included 15 cases, and group (**B**) included 15 cases as well.

Table 1: summarizes the demographic data of the patients, who underwent **SG** included in the study, while **table 2:** summarizes the demographic data of the patients who underwent **RYGB**.

Table 1: Demographic and clinical data of patients for group A

Number of SG cases	Females	Males	Range of age (year)	Age (mean)	BMI range (kg/m ²)	Co-morbidities
15	9	6	18-55	38	35-55	3(2diabetics & 1hypertensiv)

Table 2: Demographic and clinical data of patients for group B

Number of RYGB cases	Females	Males	Range of age (year)	Age (mean)	BMI range (kg/m ²)	Co-morbidities
15	8	7	18-53	34.68	35.45-74.74	8(2 diabetics, 2 hypertensive, 2 osteoarthritis, 1 gall stone, and 1 elephantiasis)

Group A: sleeve gastrectomy group:

Thirteen patients underwent **LSG** and the other 2 underwent open **SG** and 1 patient converted from **LSG** to open **SG**. Three complications (**20%**) were encountered in 3 patients from **15** patients who underwent **SG**, 2 of which were early including one case of intraoperative hemorrhage

(**6.6%**) and one case of gastric leakage (**6.6%**) in the first postoperative day, while the last one was the development of gall bladder stones (**6.6%**) detected one year after surgery.

Table 3: summarizes the different types of complications that occurred in the **SG** group.

Table 3: Complications of SG group

Total number of SG cases		15
Complications	Total	3 (20%)
	Hemorrhage	1 (6.6%)
	Staple line leakage	1 (6.6%)
	Gall bladder stones	1(6.6%)

One patient (6.6%) developed gall bladder stones 12 months after surgery. Her BMI was 50 kg/m². The diagnosis was made by abdominal ultrasound during the follow up period. The patient was asymptomatic and not diabetic. Laparoscopic cholecystectomy was done for her.

The laboratory results done during the follow up period to detect the nutritional deficiencies didn't reveal any abnormality. No complications regarding GERD, and gastric obstruction occurred. All patients achieved their expected weight loss (EWL) in their appropriate time with no incidence of weight loss failure. No mortality occurred among this group.

Group B: Roux-en-Y Gastric Bypass group:

Twelve patients underwent LRYGB and the other 3 open RYGB. Two complications (13.3%) were encountered in 2 patients. Both were late in the form of gallbladder stones (6.6%) and deep venous thrombosis (DVT) (6.6%). Both were detected 6 months after surgery.

One patient (6.6%) developed gall bladder stones 6 months after surgery. Her BMI was 44 kg/m². The patient was asymptomatic and not diabetic but hypertensive. The diagnosis was made by abdominal ultrasound during the follow up period. Laparoscopic cholecystectomy was done for her.

The other patient (6.6%) developed DVT 6 months after surgery. Her BMI was 44 kg/m². The patient complained of pain and swelling in the calf

Table 6: Incidence of complications among SG in different studies as well as ours

Study	Number of Patients	Complication rate
Cottam <i>et al.</i> ⁽⁶⁾ 2006	126	14%
Hamoui <i>et al.</i> 2006	118	15%
Frezza <i>et al.</i> 2007	53	9.4%
Triantafyllidis <i>et al.</i> 2011	85	12.9%
Mittermair <i>et al.</i> 2013	153	8 %
Kular <i>et al.</i> 2014	118	46%
Lee <i>et al.</i> ⁽⁷⁾ 2015	519	1.6%
Our study	15	20%

muscle area and the examination revealed, tender swollen calf muscle of the left leg. The diagnosis was confirmed by venous duplex. The patient started therapeutic dose of anticoagulant.

Table 4: summarizes the different types of complications that occurred in RYGB group.

Table 4: Complications of RYGB group

Total number of RYGB cases		15
Complications	Total	2 (13.3%)
	DVT	1 (6.6%)
	Gall bladder stones	1(6.6%)

Table 5: Incidence of complications in both groups

Complications	SG group	RYGB group	P value
Total	3(20%)	2(12%)	1.000
Hemorrhage	1(6.6%)	0	1.000
Leakage	1(6.6%)	0	1.000
Gall bladder stone	1(6.6%)	1(6.6%)	0.470
DVT	0	1(6.6%)	1.000

DISCUSSION

Kular *et al.* ⁽⁵⁾ found that The LSG group had a greater percentage of complications (46%) than the RYGB group (25.6%) in their study. In our study we had a greater percentage of complications among SG group (20%) than RYGB (13.3%), which goes hand in hand with the international results. However we had lower percentage of total complications compared to kular and colleagues ⁽⁵⁾.

Table 6, 7 and 8 summarizes the incidence of complications after SG and RYGB respectively among different studies as well as ours.

Table 7: Incidence of complications among **RYGB** in different studies as well as ours

Study	Number of Patients	Complication rate
<i>Chevallier et al. 2008</i>	451	11%
<i>Lee et al. 2012</i>	175	11.3%
<i>Noun et al. 2012</i>	923	6%
<i>Musella et al.2014</i>	974	15.5%
<i>Kular. et al. ⁽⁵⁾ 2014</i>	1054	5.9%
<i>Lee WJ et al.2015</i>	519	1.9%
Our study	15	13.3%

Table 8: Comparison of complications between **SG** and **RYGB** in different series

Study	Total number of patients (LSG/RYGB)	Total number of complications (%)	Number of complications in SG (%)	Number of complications in RYGB (%)
<i>Lee et al. 2015⁽⁷⁾</i>	1038 (519/519)	87 (8.4%)	38(7.3%)	49(4.7%)
Our study	30 (15/15)	5 (16.6%)	3 (10%)	2 (6.6%)

Leakage:

In our study there was one case (6.6%) of early gastric leak (first postoperative day) at the gastroesophageal junction confirmed by the routine gastrograffin meal, and it was successfully managed by surgical repair and drainage. Over sewing the staple line is not followed routinely in our practice.

Table (9) summarizes the percentage of the leakage among the different studies in comparison to ours. While **Musella and colleagues** had a total leakage of 10% divided as 0.2% from the excluded stomach, 0.5% from the gastric tube and 0.3% from the GJ anastomosis.⁽⁸⁾ There was no anastomotic leakage developed among the **RYGB** patients in our study.

Table 9: Leakage in different studies as well as ours

Study	Number of patients	Leakage (%)
<i>Frezza et al. 2007</i>	53	2 (3.7%)
<i>Lalor et al.2008</i>	148	1 (0.7 %)
<i>Mittermair et al. 2013</i>	153	3 (1.9%)
<i>Kular et al.2014</i>	284	0 (0%)
<i>Lee et al.2015</i>	519	6 (1.2%)
<i>Noun et al.2012</i>	1000	5 (0.5%)
<i>Musella et al. 2014</i>	974	7 (0.7%)
Our study	30	1(3.3%)

Hemorrhage:

Kular and colleagues had intraoperative bleeding of 3.3% in **LSG**, while in **RYGB** achieved a much lower rate of 0.98%⁽⁵⁾

There was one case (3.3%) of intra-operative bleeding during the division of the short gastric vessels and was managed as described above, in **SG** group in our study, However, in the **RYGB** group bleeding did not occur. This denotes that the incidence of bleeding in **SG** group is higher than that in **RYGB** group and that is consistent with other international publications.

Table 10: The incidence of bleeding in different studies as well as ours

Study	Number of patients	Bleeding (%)
<i>Frezza et al. 2007</i>	53	1 (1.8 %)
<i>Lalor et al. 2008</i>	148	1 (0.7 %)
<i>Mittermair et al. 2013</i>	153	5 (3.3 %)
<i>Kular et al. 2014</i>	118	4 (3.3%)
<i>Lee et al. 2015</i>	519	1(0.2%)
Our study	30	1 (3.3 %)

Cholelithiasis:

The incidence of cholelithiasis and choledocholithiasis is quite high in those who underwent **LRYGB** compared to **LSG** group; at present thought, **LRYGB** seems to be associated with increased risk of cholelithiasis but due to less

number of cases, it is difficult to compare and maybe long-term follow-up and more number of procedures will further clarify the situation. In **SG** group we had one female patient (**6.6%**) with **BMI** 50 kg/m² developed asymptomatic gall bladder stones one year after surgery.

Diagnosis was achieved by abdominal ultrasound during the follow up period. Laparoscopic cholecystectomy was done. In **RYGB** group we had also one patient (**6.6%**) that developed gall bladder stones 6 months after surgery. Her **BMI** was 44 kg/m². The patient was asymptomatic and was not diabetic but was hypertensive. The diagnosis was made by abdominal ultrasound during the follow up period. Laparoscopic cholecystectomy was done. Table (11) demonstrates cholelithiasis after **SG** in comparison to **RYGB** in different studies as well as ours.

Table 11: Cholelithiasis in different studies compared to ours

Study	Percentage of gall stone formation
<i>Kular et al. 2014</i>	10.5 %
<i>Mishra et al. 2016</i>	8.42 %
Our study	6.6%

Deep venous thrombosis (DVT):

In our study one patient (**3.3 %**) developed **DVT** 6 months after surgery. Her **BMI** was 44 kg/m². The patient complained of pain and swelling in the calf muscle area and the examination revealed tender and swollen calf muscle. The diagnosis was confirmed by venous duplex. The patient started therapeutic dose of anticoagulant.

Table 12: Deep venous thrombosis among different studies as well as ours

Study	Number of patient	Complication rate
<i>Kular et al. 2014</i>	1054	0 (0%)
<i>Musella et al. 2014</i>	974	0 (0%)
<i>Noun et al. 2012</i>	923	1 (0.10)
Our study	30	1(3.3%)

CONCLUSION

- Obesity is a worldwide epidemic accompanied with high rate of morbidity and mortality.

- Sleeve gastrectomy and Roux-en-y gastric bypass are both safe and effective procedure for the surgical management of morbid obesity.
- Sleeve gastrectomy complications include leakage, bleeding, stenosis, **GERD**, Cholelithiasis, nutritional deficiency, **DVT**, dumping; and failure of weight loss.
- Incidence of complications for **SG** is 0–24 %; and up to 46% in some studies, with a mortality rate of 0.39 %.Regarding **RYGB** highest overall complication rate was 9% among all enrolled studies with mortality rate of 0.0%-0.18%.
- Bleeding and leakage are the most common and most serious complication in both procedures.

Recommendations

- **Both SG and RYGB** are safe, short, simple and effective bariatric operations.
- **Our study** showed Roux-en-y gastric bypass has less complications than Sleeve gastrectomy.
- **Further prospective studies** have to be applied to a larger number of patients for longer periods of follow up are needed.

Many precautions should be done to prevent complications after both procedures:

1. Leakage prevention by:

Gentle handling of devices and staplers, avoiding distal stenosis, sustaining compression on the stable device before firing to washout fluids from the tissues and routine use of methylene blue test during surgery for detection of leaks.

2. Hemorrhage prevention by:

Reinforcement of stable line by oversewing with non-absorbable sutures ,applying fibrin sealant ,incorporating buttressing materials or oversewing the bare stable line with sero-serosal layer.

3. DVT prevention by:

Perioperative subcutaneous heparin administration ,use of sequential compression devices on the legs or pump on the feet.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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