laparoscopic Sleeve Gastrectomy assessment of different operative techniques

Author(s): Ahmed Mohammed Abdel Razek (M .Sc.)[1], Prof. Dr. Hosam AboulEnein[2], Prof. Dr. Mohammed Salah Eldin Abdel Hamid[3], Prof. Dr. Magdy Bassiony[4], Prof . Dr. Hesham Ahmed Abdelwahab Nafady[5]

Affiliation(s)

[1]Faculty of medicine, Cairo University.

[2]professor of general surgery, Beni-Suef University.

[3]professor of general surgery, Beni-Suef University.

[4]professor of general surgery, Ain-Shams University.

[5]Assistant professor of general surgery, Beni-Suef University.

ABSTRACT:

Background: Obesity is one of the most common global health problems. There are many bariatric surgeries to achieve the desirable weight loss. These operations are classified as restrictive, malabsorptive and mixed one. Laparoscopic sleeve gastrectomy is considered to be the second common bariatric surgeries after RYGB. We aim to assess the different techniques to do this operation including the reinforcement of the staple line by oversewing method. The

antral preservation or antral resection laparoscopic sleeve gastrectomy, the postoperative outcomes and long-term results regarding complications and improvement of comorbidities for these different techniques. ***Results:*** laparoscopic sleeve gastrectomy is a safe, acceptable and effective surgical procedure for the treatment of morbid obesity with accepted range of complications. Reinforcement of staple line has no significant impact on percentage of staple line leakage in addition to the prolonged operative time. Antral sparing and antral resection LSG both are effective techniques for treatment of morbid obese patients with good outcome regarding weight loss and improved co-morbidities of obesity.

Keywords: Morbid obesity -Bariatric surgery- Sleeve gastrectomy- Laparoscopy- gastric leakage.

Introduction:

Obesity is a common disease affecting more than 1.7 billion of population per year. It is defined as a body mass index greater than 30kg/m^2**[1].** In United States the prevalence of obesity has increased almost three folds in the past 2 decades approximately 25% of the population in United States are obese [**2**]. Current options for severe obesity are categorized by several

principles. Purely restrictive procedures include laparoscopic adjustable gastric banding and sleeve gastrectomy. Roux-en-Y gastric bypass is a restrictive surgery with a minor malabsorptive approach. Largely malabsorptive procedures with a restrictive component include duodenal switch and biliopancreatic diversion. Almost purely malabsorptive procedures include jejuno-ileal bypass [3]. Laparoscopic sleeve gastrectomy was found to be effective as a single procedure for the treatment of morbid obesity. Although LSG functions as a restrictive procedure, it may also cause early satiety by removing the ghrelin-producing portion of the stomach **[4].** After Roux-en-Y gastric bypass, LSG was the most performed metabolic bariatric procedure, LSG was recently recognized as a primary metabolic, bariatric surgical operation by the American Society for Metabolic and Bariatric Surgery and the American College of Surgeons [5]. Gastric leak is one of the most serious complications of LSG. It occurs in up to 5% of patients following LSG, leak can be classified into 2 types, subclinical leak is controlled either through a surgical drain or through a fistulous tract into the abdominal or chest cavity and clinical leak is a disseminated leak with diffusion of the contrast into the abdominal or chest cavities [6]. Performing the gastric sleeve resection procedure with a special technique called Reinforced Gastric Sleeve; this approach requires that the surgeon sutures the staple line by non-absorbable barbed sutures. This extra measure provides the stomach with an additional layer of protection this significantly reduces the chance of staple line leaks. Antral sparing in

LSG plays an important role to maintain gastric function concerning its mixing and emptying capacity **[7]**.

PATIENTS & METHODS:

This is a prospective randomized controlled study that conducted by Faculty of Medicine, Beni-Suef University and Saudi German Hospital at Bariatric Surgery Units for 30 patients who underwent LSG and from May 2015 to May 2016 then post-operative follow-up for one year. Patients divided into three main groups based on different techniques for laparoscopic sleeve gastrectomy. Group (A) 10 patients underwent staples line reinforcement antral sparing LSG starting resection in the greater curvature of the stomach 6 cm from the pylorus, group (B) 10 patients underwent antral sparing LSG with no-staples line reinforcement, starting resection 6 cm from the pylorus. Then group (C) antral resection LSG 10 patients with the vertical resection point at 2 cm from the pylorus. All patients met the criteria for the International Federation for the Surgery of Obesity and the European Association for the Study of Obesity (EASO).This inclusion criteria:

1- (BMI) greater than 40 kg/m^2.

2- (BMI) greater than 35kg/m^2 associated with relevant co-morbidities like hypertension, type 2 DM or dyslipidemia.

3- Age between18-60 years.

- **Exclusion criteria:**

1. Severe cardiopulmonary disease.
2. Bleeding disorders.
3. Severe gastro-esophageal reflux disease.
4. Psychiatric disorders on antidepressant therapy.
5. Patients with endocrinal causes for obesity like hypothyroidism.
6. Patients with previous upper abdominal laparotomy were excluded from this study.

- **Operative technique:**

After prophylactic antibiotics and general anesthesia were inducted, a Foley catheter was inserted to monitor the urine output and an 18-French naso-gastric tube was also inserted to decompress the stomach to have an adequate working space then removed and 36 French orogastric calibration tube inserted to rate the size of the gastric sleeve. All procedures performed under general anaesthesia with the patient in supine position and the surgeon positioned between the legs of the patient (French position). Carbon dioxide insufflation used to create pneumoperitoneum, using the veress needle in the left hypochondrium for all cases maintaining a 15 mmHg intra-abdominal pressure and flow rate between 2-2.5 liters/minute. After creation of pneumoperitoneum, a five-trocar approach used; 12-mm optical port inserted 25 cm from the xyphoid above the umbilicus, a 5-mm subxyphoid trocar serves as a liver retractor, an additional two 12-mm working ports are placed 3-4 cm under the left and right costal margin , the left one serves as a working port and a channel for the linear stapler and the

right one for retraction of the stomach and 5-mm left subcostal anterior axillary line trocar for traction on greater omentum.

Fig (1) ports sites for LSG.

The surgical technique was standardized between the three groups, the patient placed in a supine position with the legs open, in the reverse Trendelenburg position. A 36 French (bougie) orogastric tube inserted to calibrate the size of the gastric sleeve, prevent constriction at the Gastroesophageal junction, and provide a uniform shape to the entire sleeved stomach. Mobilization of the greater curvature of the stomach till the angle of his and left crus of the diaphragm, Gastric transection began at a point 2 or 6cm proximal to the pylorus (measured by ruler) according to each technique. With a mean number 2 cartridges with a staple height of 2.0 mm (green) at the antrum and a mean 4 cartridge, 1.5 mm (blue) at the gastric body and fundus, along the length of the orogastric tube until the angle of His was reached to. The entire

staple line inspected for bleeding, tested for leak with methylene blue (50-100mL) injection in the orogastric tube.

Fig (2) in those patients identification of the antrum and starting mobilization 2 or 6 cm from the pylorus measured by ruler.

Fig (3) By Liga-Sure (Covidien) or harmonic scalpel (Ethicon), the greater curvature is completely mobilized from, until the level of left crus of the diaphragm.

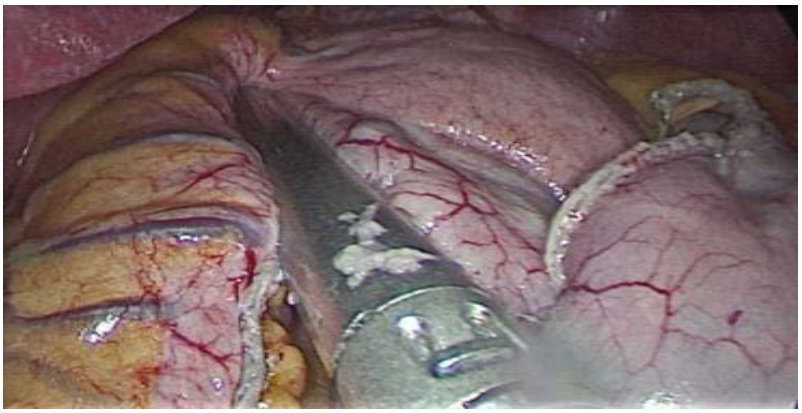


Figure (4) Creation of gastric sleeve starting by resection in the greater curvature 2 or 6 cm from the pylorus by two green cartridges 2mm height (Covidien). Blue cartridge 1.5 mm height (Covidien) are used for resection of the gastric body and fundus (average 4 cartridges), transection is competed by blue cartridges (Covidien) until the angle of his.

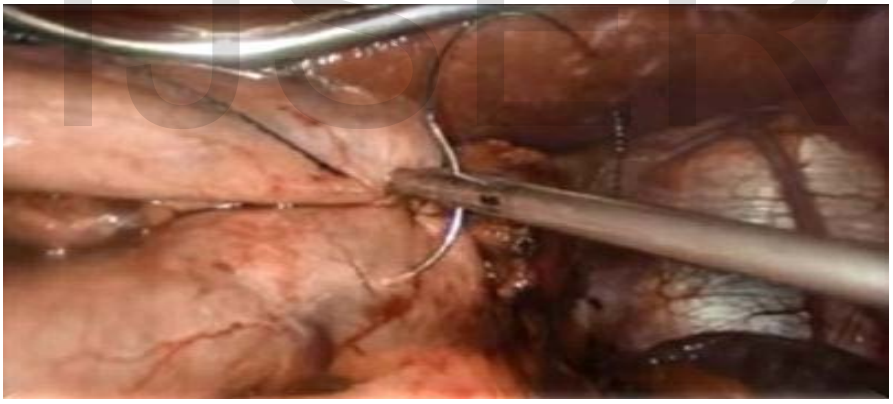


Fig (5) In-group (A) the staple reinforced through suturing with barbed sutures (Unidirectional Covidien Sutures).

RESULTS:

Patient's demographics were as follow 30 patients, 18 female and 12 males, Patients were divided between three groups by randomized method, no significant statistical difference regarding the age, sex, BMI.

Table (1) male and female incidents.

Sex	Female	Male	Total
Patient's number	18	12	30
Percentage	60%	40%	100%

Table (2) patient's demography included in the study.

	Group (A)	Group (B)	Group (C)	Total
Female	7	6	8	18
Male	3	4	2	12
Total number	10	10	10	30

1. *According to Age:*

The age of the patients ranged between 20 years and 55 years. The overall mean age 32.66 years.

Table (3) means age for each groups included in the study.

Age	

Group (A)	Mean	34.3
Group (B)	Mean	32.1
Group (C)	Mean	31.6

2. *According to Body Mass Index (BMI):*

The overall mean BMI of those patients in that study 46.3 kg/m2 (range: 40.6-52.2 kg/m^2).

Table (4) mean weight, height and BMI for each group.

		Weight	Height	BMI
Group (A)	Mean	118.4	1.61	45.71
Group (B)	Mean	122.5	1.63	46.22
Group (C)	Mean	123.6	1.64	46.08
p- value		0.643	0.732	0.69

3. *According to associated co-morbidities:*

The associated co-morbidities were as follow; seven patients had type two diabetes mellitus, eleven patients had elevated blood pressure and six patients had dyslipidemia patients distributed in the three groups as shown in table (5).

Table (5): associated co-morbidities for each group

	Group (A)	Group (B)	Group (C)	Total number
Type2 DM	2	2	3	7
Hypertension	3	4	4	11
Dyslipidemia	2	2	2	6

➢ **Operative details:**

A total number of 30 patients underwent LSG with three different techniques. Group (A) 10 patients underwent antral preserving laparoscopic sleeve gastrectomy with staple line reinforcement by suturing (AP-LSG with SLR). Group (B) 10 patients underwent antral preserving LSG without staple line reinforcement (AP- LSG without SLR). Group (C) 10 patients underwent antral resection LSG without SLR. The mean operating time was 121.8 minutes in group (A), 98.3 minutes in group (B), and 104.4 minutes in group (C). The data analysis showed significant prolonged time in group (A) with mean average 23 minutes increase in the operative time , this time was spent in reinforcement technique by suturing to the staple line with p-value less than 0.05.

Table (6) means operative time for each group.

Operation time	Group(A)	Group(B)	Group (C)
Mean(Minutes)	121.8	98.3	104.4

Operative complications:

There were no intra-operative leaks identified by methylene blue or air testing. There were no intr-aoperative complications for any of the 30 patients. All procedures completed laparoscopically without the need for conversion. The mean length of hospitalization after the operation was 3.5 (1-5) days in-group (A), 3.7 (2–7) days in the groups (B) versus 4.5 (range 2–14) days in-group (C).

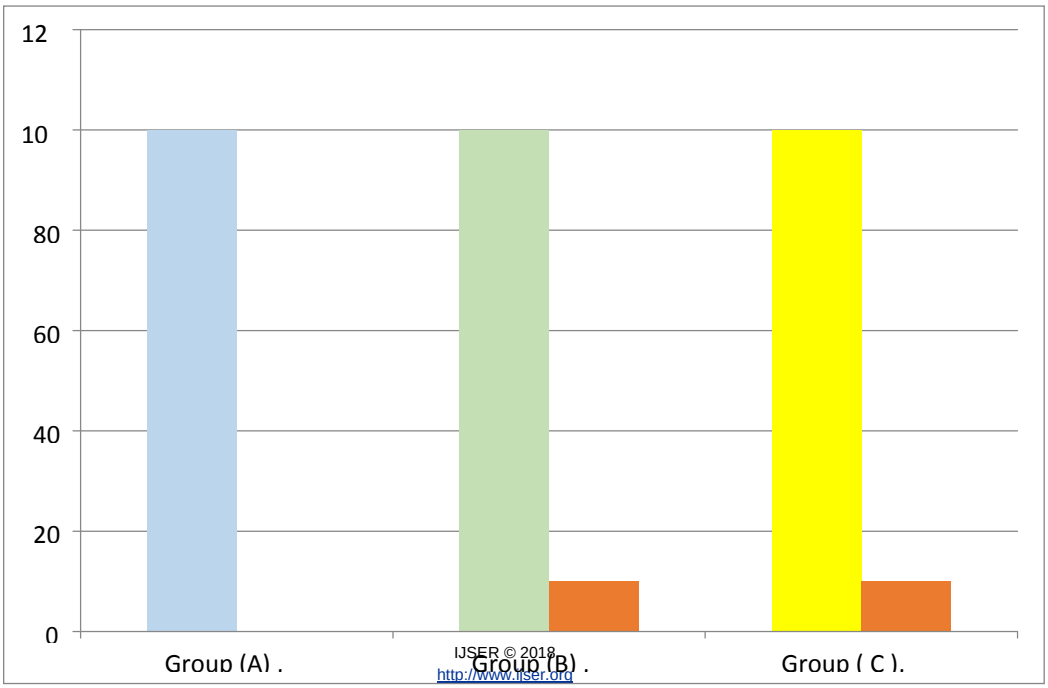
Two patients post sleeve hemorrhage admitted for 7 days, one patient post gastric leak and thrmbo-embolism admitted for 14 days, insignificant statistical differences regarding the selected techniques effect on the post-operative hospital stay.(P-value more than 0.05).

1. **Postoperative hemorrhage:**

   Postoperative hemorrhage occurred in 2 patients with overall incident (6.6%), both patients developed primary hemorrhage in the first 24 hours.The first patient in-group (B) presented 4 hours post-operative by bleeding , the intra-peritoneal drain collected about 200 ml frank blood, further examination showed tachycardia, tachyapnea, abdominal pain, tenderness

CBC done with sudden drop in the hemoglobin level more than 3 units. Pelvi-abdominal ultrasound and CT showed mild intra- abdominal collection. Patient was clinically stable and treated conservatively by two units of packed RBCs and close monitoring.The second patient was in-group (C) who presented by the same condition directly two hours post-operative, he was vitally unstable, the drain collected about 500 frank blood, sudden drop of hemoglobin level more than 4 units, this patient treated by blood transfusion with four units of backed RBCs and two units of fresh frozen plasma, urgent re- operation through laparoscopy, a bleeding vessels in the greater curvature of the stomach was identified and managed by haemostatic clips then peritoneal toilet and drainage. Postoperative bleeding did not occur (0%) in all patients of group (A) with staples line reinforcement technique by inversion and suturing to the staple line.

The statistical tests and data analysis showed that the staple line reinforcement by suturing



significantly reduce the incident of postoperative hemorrhage (with p- value less than 0.02).

Fig (6) incidents of post-operative bleeding in each group

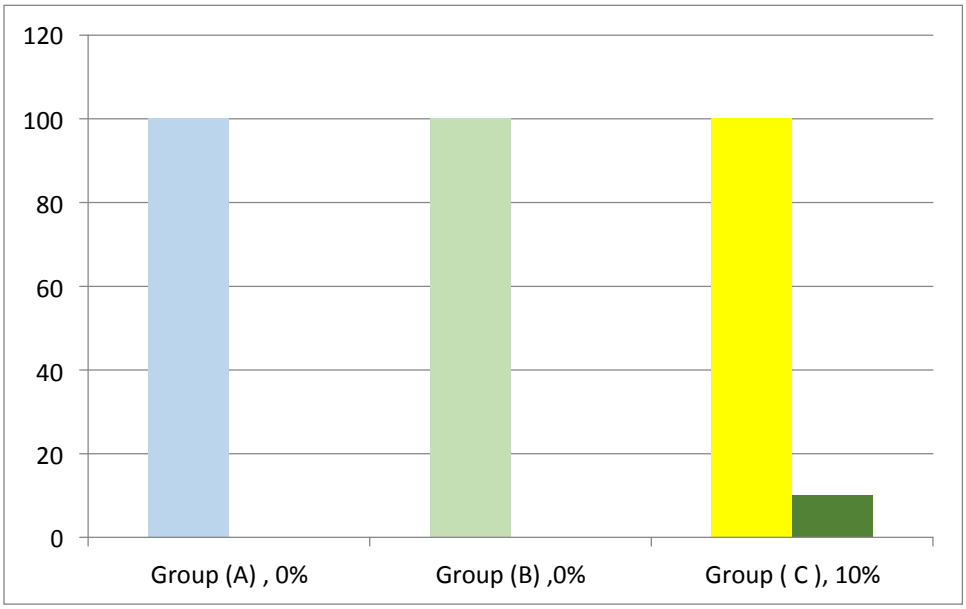
Table (7) incidents of post-operative bleeding and their management.

Surgical technique	Total (n)	Type of hemorrhage	management	Incident of bleeding
Group (A)	0	no	n o	0%
Group (B)	1	mild	Blood transfusion	10%
Group (C)	1	moderate	laparoscopy and clipping of the bleeding vessels	10%

2. Postoperative gastric leak:

The overall incident of gastric leak was 3.3%. one patient from total 30 patients diagnosed to have early post-operative leak, that leak occurred with antral resection LSG group (C) with 10% incident of leak in that group. That patient presented on the third day (mechanical leak) by abdominal pain, vomiting, tachycardia, tachyapnea, mild fever, increased white blood cells count and (CRP) level, computed tomography scan showed localized contrast collection near the gastro- esophageal junction (type-1 gastric leak with moderate symptoms and signs of sepsis). Intravenous antibiotics, fluids resuscitation then upper endoscopy and insertion of Mega stent (self- expanded coated stent) succeeded to control that leak, stent removed after 6 weeks and contrast study showed no further leak.

No leak (0%) recorded with antral sparing groups (A) and (B) with or without reinforcement to the staples line by suturing. Data analysis showed insignificant effect regarding the benefits of reinforcement to the staple line on the post- operative gastric leak, but it showed high incidence for postoperative (mechanical) gastric leak occurred for patients who underwent antral resection LSG group (C) with (**p**-value 0.01).



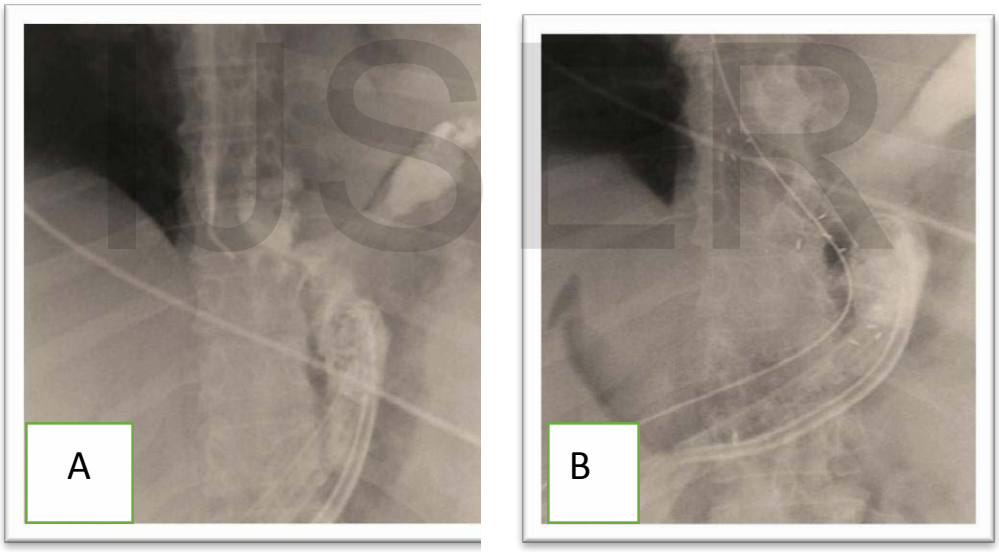


Fig (7) incidents of post-operative leak for each group.

Figure (8); (A) Gastrografin fluoroscopy for the above mentioned patient post antral resection LSG with localized leakage at gastro-esophageal junction, (B) complete

improvement with no further leak after stenting by self- expanded coated stent (Mega stent) for 6 weeks.

Table (8) postoperative gastric leak after LSG

Surgical technique	Patient's numbers	Type of leak	management	Incident of leak
Group (A)	no	No	no	0%
Group (B)	no	No	no	0%
Group (C)	1	Type-one gastric leak	Endoscopy and mega stenting	10%

3. *Post-operative stenosis after LSG.*

one case with antral resection LSG in group(A), developed severe persistent vomiting in the fifth postoperative month not improved by proton pump inhibitors and antiemetic medications, further investigations by upper endoscopy and gastrografin follow-through showed severe stenosis in the gastric pouch opposite the incisura. In that case, the symptoms disappeared after two sessions of endoscopic dilatation using 16 and 18 mm balloons dilatation. The patient discharged with a well- tolerated oral diet after admission for 7 days. Relation between the selected technique and the occurrence of stenosis was insignificant.

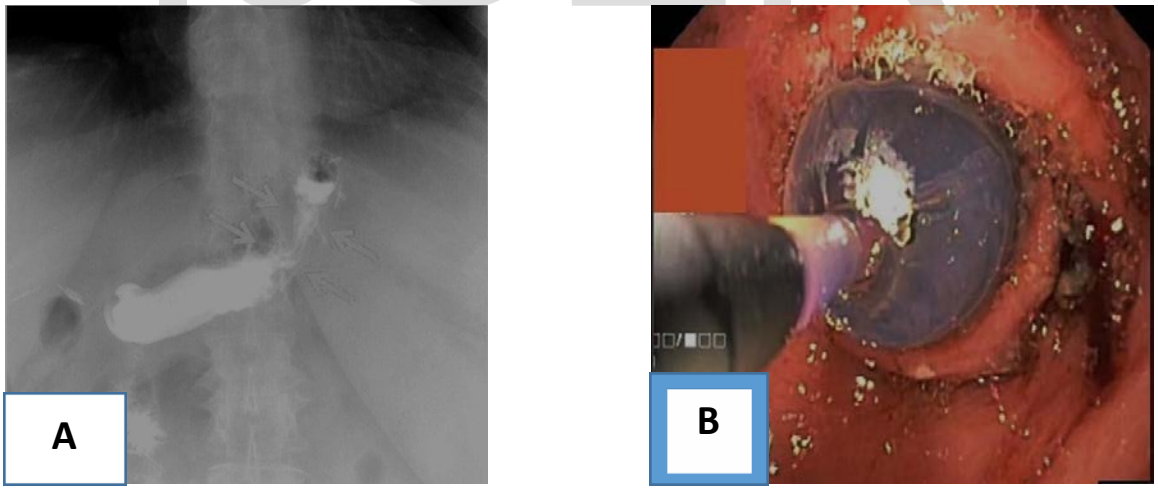


Figure (9); A) Gastrografin fluoroscopy, stricture opposite the incisura angularis for that patient in-group (A); B) succeeded balloon dilation for that patient.

Assessment of Postoperative excess weight loss after LSG.

In the antral preserving groups (A) and (B) the mean EWL was 42.3% and 41.4% respectively in the first year. Reinforcement to the staple line by by suturing had insignificant effect in the EWL after LSG, *p*-value more than 0.05. Patients with antral resection group (C) had mean EWL 53.4% after the first year. Data analysis showed significant best outcomes in- group (C) regarding the long term EWL (*p*-value less than 0.01).

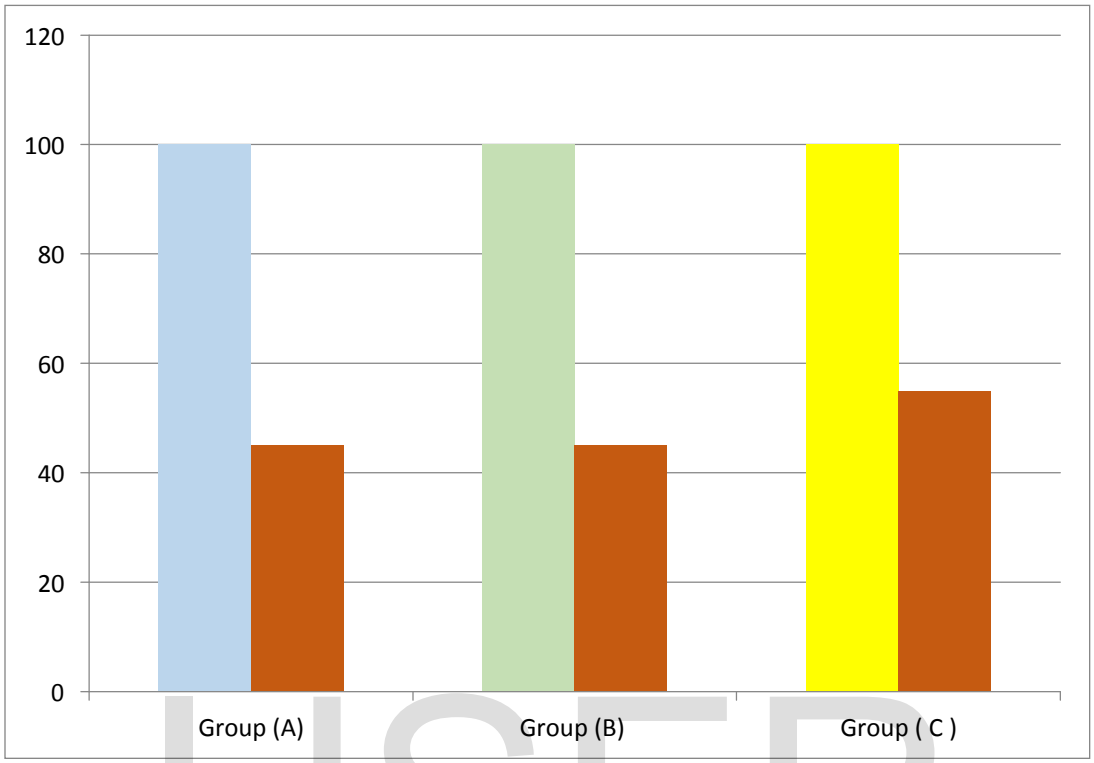


Fig (10) percentages of EWL after one year for each group, significant excess weight loss in all groups, best results noticed with the antral resection LSG after the first year.

Table (9) mean percentages of postoperative excess weight loss (EWL) after each LSG techniques at one year.

		EWL%
Group (A)	Mean	42.3%
Group (B)	Mean	41.4%

Group（C ）	Mean	53.4%

Table (10) different changes in the BMI after one year of LSG.

	Group (A)	Group (B)	Group (C)
Pre-operative BMI (kg/m^2).	46.01	46.62	45.59
BMI at one year (kg/m^2).	32.15	31.85	26.8
Mean BMI differences after one year	13.86	14.77	18.79

CONCLUSION:

Laparoscopic sleeve gastrectomy (LSG) improves comorbidities such as type-2 diabetes mellitus, hypertension and dyslipidemia, though this may be a consequence of weight loss, the hormonal mechanisms that may contribute to this effect **[8].** Regarding our current study (thesis), it is a prospective randomized controlled study between a total numbers of 30 patients underwent LSG with three different techniques. The data analysis showed significant prolonged time in group (A) with mean average 35 minutes were consumed, this time was spent in reinforcement technique by suturing to the staple line (*p*-value less than 0.005). The different techniques for LSG have no significant impact in post-operative hospital stay (*p–value* more than 0.05).

Post-operative hemorrhage occurred in 2 patients with overall incident (6.6%). The statistical tests and data analysis showed that the staple line reinforcement by suturing significantly

reduce the incident of postoperative hemorrhage (with p-value less than 0.02). The overall leak frequency was 3.3%, one patient from 30 patients, occurred with antral resection group (C) with 10% incident of leak in that group. Data analysis also showed that a significant high incidence for postoperative gastric leak occurred in patients with antral resection group(C). No leak (0%) occurred with antral sparing groups (A) and (B), no significant effect regarding the benefits of reinforcement to the staple line on the post- operative gastric leak with (*p*-value 0.01). In this study, one patient suffered postoperative leak in group (C) antral resection LSG group with 10% incident of leak in that group, this was most probably mechanical leak due to increased intra-gastric pressure as it occurred early days postoperatively. There was no significant difference regarding the rate of postoperative bleeding in the antral resection group or antral sparing one.

Data analysis showed significant best outcomes for weight loss in group(C) with significant effect for antral resection LSG on the long term EWL (*p*-value less than 0.01). Regarding post-operative stricture, overall incident of stenosis in all groups was 3.3% with insignificant relation regarding the selected technique (P- value more than 0.05). There are limitations to this study: the number of patients included is small, and the follow-up period was short. However, we were able to show that antral resection-LSG and Antral preserving- LSG are efficient operations regarding weight loss, reduction in co- morbidities; we believe that both LSG techniques are valuable surgical alternatives for selected patients with morbid obesity.

Long-term follow-up data and larger studies are needed to confirm these results.

REFRENCES

1. Deitel M. Overweight and obesity worldwide now estimated to involve 1.7 billion people. Obes Surg. 2013; 13:329–30.

2. Shields M, Carroll MD, Ogden CL. Adult obesity prevalence in Canada and the United States. NCHS Data Brief. 2011;56:1.

3. Moon Han S, Kim WW, Oh JH. Results of laparoscopic sleeve gastrectomy (LSG) at 1 year in morbidly obese Korean patients. Obes Surg. 2011; 15:1469–75.

4. Frezza EE. Laparoscopic vertical sleeve gastrectomy for morbid obesity. The future procedure of choice?Surg Today. 2007;37:275–81.

5. Gumbs AA, Gagner M, Dakin D, et al. Sleeve gastrectomy for morbid obesity. Obes Surg. 2007;17:962–9.

6. Michael Ganger MD , surgery of obesity and related diseases (vol. 10) 2014 ,Page 713 : 723 .

7- Padwal RS, Lewanczuk RZ. Trends in bariatric surgery in Canada 2008-2012. CMAJ 2012;172:735.

8-Márquez MF, Ayza MF, Lozano RB, et al. Gastric leak after laparoscopic sleeve gastrectomy.ObesSurg 2012;20:1306-11.