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ORIGINAL ARTICLE

Early Complications Post Laparoscopic Sleeve Gastrectomy

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ABSTRACT

Background: Obesity, defined as a body mass index (BMI)≥30kg/m2, is a chronic illness identified in children, adolescents, and adults worldwide. Bariatric surgery has been recognized as the most effective long term treatment modality for severe obesity. Among various bariatric procedures, laparoscopic sleeve gastrectomy (LSG) has rapidly gained popularity to become most frequently perform worldwide. LSG entails resecting the greater curvature and fundus of the stomach; the partial gastrectomy is oriented vertically, parallel to the lesser curvature of the stomach.
Aim of the study: To evaluate the early complications post LSG.
Patients and method: Prospective cohort study carried on 2560 obese patients, between first of January, 2016, and 31 December, 2019, underwent bariatric surgery by the same surgeon and same surgical team at Baghdad Teaching Hospital, Diglah Private Hospital, AL Kemah Surgical Hospital and AL Ameerat Private Hospital. 30-day perioperative complications were analyzed.
Results: Perioperative early complications were presented in (3.01%) and divided into major and minor complications; in major complications the most common complication were major bleeding (0.59%), then leak in (0.47%). Minor complications: Transient intolerance to food were the most common (0.66%), chest infection (0.42%). (37.8%) patients were presented with comorbid diseases; in which DM (15.7%), HT (13.5%), knee and back arthralgia in (2.6%).
Conclusion: laparoscopic sleeve gastrectomy found to be a safe bariatric operation with acceptable postoperative complications (3.01%).

Keywords: Obesity, Laparoscopic Sleeve Gastrectomy, Complications

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1. INTRODUCTION

Obesity, characterized by a body mass index (BMI) of ≥30 kg/m², is a chronic condition recognized in children, adolescents, and adults globally. (1,2) Obesity is associated with numerous recognized health risks, including type 2 diabetes mellitus, cardiovascular disease, stroke, various malignancies (e.g., breast, colon, uterine), osteoarthritis, hepatic disease, obstructive sleep apnea, and depression. (3-6)

Medical and behavioral methods for weight loss may be futile for several obese persons. For these individuals, the most effective approach for achieving and maintaining substantial weight loss, as well as addressing comorbidities such as hypertension, hyperlipidemia, sleep apnea, and type 2 diabetes mellitus, is bariatric surgery. Patients who have bariatric surgery exhibit reduced long-term death rates in comparison to matched controls who did not receive the procedure. (7)

The Body Mass Index (BMI) is the recognized standard metric for assessing overweight and obesity. BMI serves as a metric for assessing weight relative to height, calculated by dividing body weight (in kilograms) by the square of height (in meters). Additional indicators of pediatric obesity encompass weight-for-height (especially pertinent for children under two years), assessments of regional fat distribution (such as waist circumference and waist-to-hip ratio), and the growth standards established by the World Health Organization (WHO). (8,9)

The most successful long-term therapy option for severe obesity is bariatric surgery. Of the numerous bariatric surgeries, laparoscopic sleeve gastrectomy (LSG) has quickly become the most common procedure performed globally. (10, 11)

In the United States of America a total of 125318 LSGs were carried out during 2016, making up 58% of all bariatric procedures carried out that year. This figure rose by 18.8% from 2015 and 346% from 2011. LSG involves resecting the stomach's fundus and greater curvature; the partial gastrectomy is positioned vertically, parallel to the stomach's lesser curvature. LSG is recognized by the American Society for Metabolic and Bariatric Surgery (ASMBS) as either the initial step of a tiered strategy or a primary bariatric treatment in. (12)

Bariatric surgery (BS) refers to surgical procedures designed to treat and/or manage obesity. The different surgical techniques are classified into three groups: restrictive techniques, malabsorptive techniques, and mixed or combined techniques. (13,14)

Restrictive techniques reduce gastric capacity, causing the patient to ingest a smaller volume of food; an example of this is the sleeve gastrectomy procedure. Malabsorptive techniques aim to reduce the intestinal absorptive surface area, as is the case with gastric bypass. Mixed methods, as their name indicates, involve a combination of restrictive and malabsorptive procedures, such as biliopancreatic diversion. (15)

Thanks to the advent of minimally invasive bariatric surgery (MIS) and its subsequent inclusion in general surgeon training programs, the safety of this type of surgery has increased, and a decrease in postoperative complications has been achieved, although these complications remain a focus of attention for all specialists dedicated to the practice of bariatric surgery. (16)

Recent WHO reports indicate that young people are increasingly prone to obesity each year, and that over 30% of the adult population is obese. This leads to these patients developing chronic non-communicable diseases, such as hypertension, diabetes mellitus, kidney failure, and osteoarthritis, which increase the risk of intra- and postoperative complications. (17,18)

Obesity is a disease that affects millions of people, both in developed and developing countries. This translates into a higher number of bariatric surgeries (BS), leading even non-bariatric laparoscopic surgeons to perform this procedure without adequate training. Thus, in addition to the general complications of bariatric surgery, there are those inherent to bariatric techniques, such as anastomotic leak, staple line failure, gastrointestinal bleeding, internal hernias, weight regain, and gastric sleeve stenosis, among others. (19,20)

Despite the above, bariatric procedures such as gastric sleeve, gastric bypass, and, in recent years, mini- gastric bypass, account for 80% of surgeries performed worldwide, according to Mikler et al. (21), other researchers report adequate control of diseases such as type 2 diabetes mellitus, hypertension, and dyslipidemia in patients treated with bariatric surgery. (22,23)

Appropriate patient selection leads to a favorable postoperative outcome, improved quality of life, and reduced expenditure of institutional resources and supplies. In this way, complications

2. METHODOLOGY

This was a retrospective analysis of the collected data of 2560 obese (2079 females,418 male) patients who were underwent bariatric surgery by the same surgeon and surgical team during the period from first of January 2016 to the endothelin-1 of December 2019 at Baghdad Teaching Hospital, Diglah Private Hospital, AL Kemah Surgical Hospital and AL Ameerat Private Hospital. between

Inclusion criteria:

1. Patients of both genders at age of 15 to 60 years
2. Body mass index of 35 to 60 kg/m²
3. Had comorbidities related to obesity (Like: diabetes and hypertension).
4. Underwent LSG

Exclusion criteria:

Patient was excluded if he/ or she had one or more of the following:

1. Previous LSG and planning for redo sleeve gastrectomy.
2. Gastroesophageal Reflux Disease (GERD).
3. Extremely high risk for operation.
4. Cannot be compliant with lifelong diet, exercise, behavior modification.
5. Contraindications for laparoscopic surgery.

Preoperative Evaluation:

The age, sex, BMI and findings of chest and heart examination were reported. All patients were investigated for complete blood picture (CBP), blood glucose level, liver function test, renal function test, thyroid function test, serum cortisol, ACTH and virology screen done for hepatitis B, C and HIV. Other specific investigations were performed; esophagogastroduodenoscopy preferred in selected patient with GERD, pulmonary function tests, chest radiography, abdominal ultrasound, ECG and ECHO were performed.

Every patient was instructed to adhere to a low-carbohydrate, high-protein fluid diet for two weeks prior to surgery.

Postoperative care:

On postoperative day 0, patient kept nothing by mouth for 3 days, advised to encourage early mobilization after 2-3 hours. after surgery and encourage chest physiotherapy early with respirometer.

Treatment included I.V. Fluid according to weight of patient, prophylactic antibiotics, antiemetics (Ondansetron), PPI (Nexium), analgesics (Acupan) and LMWH given 8 hours post operative for five days and convert to oral tab on day 5 postoperative, in high risk, morbidly obese and history of DVT or P.E.

A clear fluid-diet is subsequently initiated on Day 3 and patient was discharged home on PPI for 2 months.

Follow up:

All patients kept on oral PPI (Nexium) for 2 months, and diet regimen schedule for 2 months starting with clear fluids reaching solid food after 2 months gradually. Fiest visit on day 5 post operative removing drain and prescription of sachets of multivitamins. The second visit is after 30 days. The mean operative time, hospital stay, intraoperative, and early postoperative complications (within first months) were recorded in the form of bleeding,

vomiting, leakage, splenic injury, stenosis, gastric malrotation, wound infection and excess weight loss (EWL) and comorbidity.

Statistical analysis:

Data were entered using the Statistical Package for Social Sciences (SPSS) version 23 Descriptive statistics presented as (mean ± standard deviation), frequencies and percentages. Appropriate statistical tests performed, Chi-square used for categorical variables (Fishers exact test used when chi-square was inapplicable). Students t-test used to compare two means, one-way ANOVA analysis used to compare more than two means.

3. RESULTS

The current study enrolled 2560 obese patients and they underwent bariatric surgery; females were 2079 represented (81.2%) and males were 418 (18.8%) of the studied group. The mean age of patients was (39.4±7.8) years, and mean BMI were (43.9 Kg/m^2), (**Table 1**).

The current study show that 967/2560 (37.8%) patients were presented with comorbid diseases; in which Diabetes Mellitus presented in 401 (15.7%), Hypertension in 345 (13.5%), knee of back arthralgia in 67 (2.6%), CHD in 59 (2.3%), PCOS in 41 (1.6%), Arrhythmia in 38 (1.5%), infertility in females 14 (0.55%)

As shown in (**Table 2**), the Peri-operative early complications were presented in 77/2560 (3.01%) and divided into major and minor complications;

1. In major complications the most common complication was major bleeding 15 (0.59%), then leak in 12 (0.47), hematoma in 3 (0.11), DVT in 2 (0.078), PE 2 (0.078), Mesenteric ischemia 2 (0.078), hematemesis 1 (0.039), Panniculitis 1 (0.039) and abscess collection 1 (0.039).

2. Minor complications: Transient intolerance to food were the most common 17 (0.66%), chest infection 11 (0.42%), port site infection 3 (0.11%), acute calculous cholecystitis 3 (0.11%), arrhythmia 3 (0.11%), and pancreatitis in 1 (0.039%)

Regarding the diagnostic and treatment approaches of post LSG complications were tailored according to clinical needs and the patient's characteristics. These approaches are summarized in (**Table 3**).

Among the studied group, reoperation was required in 37 cases; open surgery were done in 14 patients; for leak in 8 (0.31%), port site infection in 3 (0.11%) patients, mesenteric ischemia in 2 (0.078%), and Panniculitis in only one (0.039%) patient. Laparoscopy were done in 23 patients; for management of bleeding in 12 (0.47%) patients, leak in 4 (0.15%) patients, hematoma in 3 (0.11%), acute calculous cholecystitis in 3 (0.11%), and abscess in one patient (0.039%), (**Table 4**).

Table 1. Demographic criteria of the studied group

Gender, n (%)	Female	2079 (81.2)
	Male	481 (18.8)
Mean age (years)		39.4
Mean BMI (Kg/m2)		43.9

Table 2. Postoperative LSG complications (major and minor) (n=77)

Variable	No.	%
Early complications (n=77)		
• **Major (n=39)**		
Major bleeding	15	0.58
Leak	12	0.47
Hematoma	3	0.11
DVT	2	0.078
Pulmonary embolism (PE)	2	0.078
Mesenteric ischemia	2	0.078
Hematemesis	1	0.039
Panniculitis	1	0.039
Abscess collection	1	0.039
• **Minor (n=38)**		
Transient intolerance to food		
Chest infection	11	0.42
Port site infection	3	0.11
Acute calculous cholecystitis	3	0.11
Arrhythmia	3	0.11
Pancreatitis	1	0.039
Total complications	**77**	**3.1**
Mortality	**2**	**0.078**

Table 3. Diagnostic approaches and treatment of post LSG complication

Complication	Diagnostic approach	Treatment
Bleeding	**Clinical**: Tachycardia and Hypotension with drain leakage	12 cases re-laparoscopy, clipping of bleeding stapler line
	Laboratory: Drop in Hemoglobin with	3 conservative treatments
Leak	**Clinical**: Tachycardia, fever anorexia and shoulder pain **Laboratory**: Leukocytosis, thrombocytosis **Radiology**: Ultrasound and CT Abdomen confirm leakage.	Roux en y gastric bypass
Hematoma	**Clinical**: Tachycardia, fever, anorexia	Drainage
Mesenteric Ischemia	**Clinical**: Tachycardia, fever anorexia Laboratory: Leukocytosis **Radiology**: CT abdomen confirm diagnosis	Segmental resection and anastomosis
Panniculitis	**Clinical**: Tachycardia, fever anorexia Laboratory: Leukocytosis **Radiology**. CT abdomen confirm diagnosis	Partial omentectomy
Abscess	**Clinical**: Tachycardia, fever anorexia Laboratory: Leukocytosis **Radiology**. Ultrasound and CT abdomen confirm diagnosis	Drainage
Hematemesis	**Clinical**: Tachycardia, hypotension and hematemesis **Laboratory**: drop in hemoglobin on serial CBP	Conservative Treatment with blood transfusion
DVT	**Clinical**: calf pain and unilateral led edema **Imaging**. doppler ultrasound confirm diagnosis	Conservative treatment
P.E	**Clinical**: dyspnea, tachycardia **Radiology**. CT chest confirms	Respiratory care unit admission and mortality of those 2 cases

Table 4. Reoperation post LSG

Type of surgery	Complication	N	%
Open (n=14)	Leak	8	0.31
	Port site infection	3	0.11
	Mesenteric ischemia	2	0.078
	Panniculitis	1	0.039
Laparoscope (n=23)	Bleeding	12	0.47
	Leak	4	0.15
	Hematoma	3	0.11
	Acute calculous cholecystitis	3	0.11
	Abscess	1	0.039

4. DISCUSSION

Following combined techniques (biliopancreatic diversion), Yupanqui et al . documented the presence of metabolic complications such as protein-energy malnutrition, with an incidence between 7-12%. Other metabolic complications include deficiencies in the fat-soluble vitamins A, K, and D. Long-term anemia is another complication, secondary to deficiencies in iron, folic acid, and vitamin B12; therefore, oral supplementation of these vitamins is necessary for anemia treatment. (24)Vitamin B deficiency after surgery and its sequelae on health have been described by Al Mansoori et al(25) , in addition to the development of mental, cognitive, and neurological disorders such as depression or anxiety. Thiamine deficiency is even associated with the presence of Wernicke's encephalopathy. To prevent this syndrome, treatment with multivitamin compounds is proposed for patients undergoing biliopancreatic diversion. (26) Herrera (27) also refers to the impact that biliopancreatic bypass surgery has on the patient's metabolic environment. Iron, zinc, and calcium deficiencies affect bone mineral density in the long term, which predisposes these patients to osteoporosis and osteopenia. Ocón et al., in their study of 70 operated patients, comparing gastric bypass and biliopancreatic bypass procedures , found a greater number of metabolic and nutritional complications in the latter, with anemia being the most common. Iron deficiency was reported in 36.6% of the cases operated on using the biliopancreatic bypass technique . Other complications of this origin were hypoalbuminemia, decreased levels of folic acid, and vitamin B12 . (28)

Among the benefits of outpatient surgery are undoubtedly the low rates of surgical-related infectious complications, reaching only 4%. In obese patients, the risk of surgical site infection (SSI) is higher than in normal-weight patients. This is due to reduced tissue oxygenation and perfusion, deficient serum concentrations of antimicrobials, and a higher incidence of chronic non-communicable diseases such as diabetes mellitus. (29)

Guilbert et al.) emphasize, first and foremost, the importance of bariatric procedures being performed in high-volume centers, defined by the American College of Surgeons and the American Society for Metabolic and Bariatric Surgery as those performing at least 125 procedures annually, with specialized personnel and appropriate equipment. In their study of 500 cases operated on over four and a half years, using gastric sleeve and gastric bypass , they reported the following early complications: fistula (3.2%), endoluminal bleeding (1.6%), atelectasis (1.6%), and postoperative abdominal bleeding (0.8%); while the findings regarding late complications were: iron deficiency anemia (5%), cholecystitis with gallstones (4.8%), internal hernia (0.8%), and gastrojejunal stenosis (0.6%). (30)

Guzmán et al . found fewer postoperative complications with sleeve gastrectomy and adjustable gastric banding procedures compared to gastric bypass . Only two (0.04%) deaths were reported in the latter group. Major complications included atrial fibrillation, gastrointestinal bleeding, hemoperitoneum, thromboembolic disease, and intra-abdominal fluid collection. Minor complications included surgical site infections, nosocomial pneumonia, gallstones, and incisional hernia.(31)

Over the past three years, the COVID-19 pandemic has led to the restructuring, modification, and updating of operating protocols across various healthcare services. The CB (Center for Biomedical Research) was no exception. Nedelcu et al., results supporting the conclusion that having had COVID-19 is not a contraindication for surgery. Furthermore, they reported that patients who required invasive mechanical ventilation during the illness were no more likely to develop postoperative complications than those who experienced a mild form of the disease. (32)

The current study found the leak rate was 0.47%, which is promising linked to other issued revisions. which is consistent with Noel et al., in their single center study, indicated that

gastric leak rate after laparoscopic sleeve gastrectomy were diminished in accordance with the learning curve, exhibiting an average rate of 1% (ranging from 0% to 5.7%). (33)

A similar trend was noted by Stroh et al., who examined the German registry documenting 11,800 SG conducted between 2007 and 2013. (34)

Furthermore, Berger et al. reported a leak rate of less than 1% in 189,477 sleeve gastrectomies performed by 1634 surgeons at 720 American centers for 3 years duration (2012-2014). (35) Stroh et al. (36) have found several risk variables for a leak during SG surgery. It was confirmed that intraoperative difficulties elevated the chance of leakage.

Srinivasa et al.(37) reported the highest leak rate at 12.8%, whilst Iossa A et al.(38) recorded no leakage. within a cohort of 41 LSGs. To prevent leaks, tissues must be handled meticulously, and instruments such as staples, electrocautery, or other surgical tools should be utilized judiciously.

In the current study, the technical elements in decreasing leaks were :

1. Bougie size play a role in leak in our study in some studies. The Rosenthal study indicates that nearly ninety- of the participants concurred that the ideal size of the bougie should range from 32 to 40 Fr. (39) A recent study by Yuval et al. (59) determined that the utilization of bougies measuring 40 Fr or larger sized was linked to a dripping rate of 0.92%, compared to 2.67% for smaller bougies. (40)

2. Maintaining the proximal posterior connections and vascular supply to the sleeve. It is observed that it plays a crucial role in reducing leak occurrences in the current study. During surgery, tiny arteries within the posterior attachments are often visible. Maintaining those attachments and veins may safeguard crucial blood flow to the proximal sleeve and diminish the likelihood of leakage.

3. Positioning the linear stapler to the left and exceeding 15 mm from the actual gastroesophageal junction. The last stapler is positioned at an angle to the left of the fat pad.

4. Apposition of the omentum to rest adjacent to the completed staple line. Hemorrhage poses significant risks, potentially resulting in life-threatening problems for the patient.The predominant site of hemorrhage is the staple line during gastric transection; however, it may also arise from the gastroepiploic or small gastric veins during the dissection of the greater curvature.

The current study found bleeding occurs in (15) cases were all from stapler line,which is 0.58% as we doing as Sroka et al (41), proposed routine elevation of the systolic blood pressure to 140mmHg before termination of the procedure in order to identify and clip any bleeding staple line bleeding possible oozing sites.

Hemorrhaging was predominantly observed in a study conducted by Melissas et al. (42)15.8%, but none was documented by Lee et al. (43).Mittermair et al. (44) reported a postoperative bleeding rate of 3.3%, while Sakran et al. (45) reported a rate of 2.1%. De Angelis et al. (46) documented a bleeding incidence of 1.9% associated with splenic damage and suture line. The selection of cartridge height for stomach thickness and adherence to tissue compression length prior to stapling are two critical factors in preventing hemorrhage.Multiple technical methods are available to strengthen the staple line: oversewing (using stitches or running sutures), metallic clips, biological sealants, and buttress materials, which may be absorbable or permanent; we utilized metallic clips for reinforcement. (45,46)

In a cohort of 164 patients undergoing laparoscopic sleeve gastrectomy, Lalor and associates, documented one case of an abscess (0.7%). Treatment comprises percutaneous drainage and antibiotics, whereas we present one case of an abscess, constituting 0.03% of all patients, which was drained laparoscopically.(47)

In the present study the DVT were found in (0.078%) of the patients, which is less than that found in Boza et al. study, describe 17 (1%) patients with DVT following LSG. The incidence of DVT were increased after 3 months from the operation and reach to 2.1%, and more than half of them the postoperative DVT happened after discharge from hospital and within 1 month postoperatively. (48)

Symptomatic cholelithiasis manifested quickly after LSG in 0.7% of cases. Sucandy et al. documented a 1% occurrence of early symptomatic cholelithiasis 9 days following LSG, whereas our data reveals a 0.11% incidence of calculus cholecystitis 15-22 days post-LSG. The temporary intolerance to food was observed in 0.66% of the patients in our study. (49) Khalifa I et al. identified that food tolerance to foods improved substantially after a period of three to six months when the gastric resection distance from the pylorus was extended to 6 cm, compared to initiating resection 2 cm from the pylorus. (50) Mortality in current study was 0.078% which is due to PE and no case reported mortality with leak in our study which is very

favorable as compared to published series, Razek M et al, (51) revealed that the mortality rate was 0.7%, one case due to pulmonary embolism after 2 weeks from LSG. In Ali M et al. (52) mentioned that the overall mortality rate of laparoscopic sleeve gastrectomy range from about 0–1.2%.

5. CONCLUSIONS

The current study concluded that laparoscopic sleeve gastrectomy found to be a safe bariatric operation with acceptable postoperative complications. However, we recommend conducting further multicenter and technical detailed studies on laparoscopic sleeve gastrectomy leading to lowered leak rate and compare the outcome results every year.

Ethical Approval:

All ethical considerations were reviewed and approved by the authors. Patients' enrollment and data collection adhered to the World Medical Association's Declaration of Helsinki, 2013 for the ethical principles of researches involving human. Written informed consent was obtained from each participant and all data were handled confidentially.

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