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Incidence and Management of Early Complications of Laparoscopic Sleeve Gastrectomy for morbid obesity; Case series and Literature Review

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Abstract: Background: One of the most common operation for weight loss is the laparoscopic sleeve gastrectomy which are an effective and relatively safe. Diagnosis of leakage is mainly based on clinical suspicion and lab radiological evidence. The Laparoscopic sleeve gastrectomy is superior in comparison to other restrictive procedures due to the decrease of large parts of ghrelin producing stomach mass. **Aim of work:** To estimate the incidence of early complications following laparoscopic sleeve gastrectomy and how to manage those complications. **Patients and Methods:** This study is a prospective case series which has been conducted at Ain Shams University Hospitals recruiting 300 patients who underwent laparoscopic sleeve gastrectomy upon between March 2017 and March 2018 with minimal follow up of one month postoperatively. Prospective data were reviewed from patient files. **Results:** Our study included 300 patients with mean age 37.1 ± 20. The mean body mass index was 41.95 ± 4 while body mass index (BMI)< 40 kg/ m^2 was 5% and BMI was 40 -50 kg/ m^2 was 95%. Medical co-morbidities were in the form of hypertension in 30% of cases, DM in 40% of cases and obstructive sleep apnea in 6% of cases. The operation time was 30-40 min and the average of hospital stay was 1.2 (1-4) days. The postoperative complications were staple line leakage in 0.6% of the cases, staple line he in 0.6% of cases, wound infection in 0.3% of cases, portal vein thrombosis in 0.3% of cases and chest infection in 0.6% of cases. **Conclusion:** Leakage and hemorrhage after LSG are diagnosed clinically and by radiological investigations. Mesenteric Venous Thrombosis is a subtle complication that warrants high index of suspicion for immediate management. Further studies are needed to detect the best treatment methods for early complications.

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Keywords: Laparoscopic Sleeve Gastrectomy, early complications, leakage, hemorrhage.

1. Introduction

The incidence of morbid obesity is growing, accompanied with elevating in the frequencies of diabetes, cardiovascular disorders, arthritis and initial mortality. It's expected to face a rising cost of health service in the coming decades as the obesity population getting older. Of course Dietary, Nutrition and pharmacological interventions get the best results on the short term, but usually fail. On the other hand Surgical interventions offers a safe and permanent Long term weight reduction result ***(1)***.

After considerable weight reduction cardiovascular disease, diabetes, arthritis and hypercholestrelemia have been shown to improve, and may to resolve completely. Morbid obesity, in addition is mainly liked with elevation in the incidences of anxiety and depression as far as increases the risk of metabolic and physiological abnormalities***(2).***

Dietary, Nutrition and pharmacological interventions fail to maintain long term weight loss in obese patients; as a result surgical interventions are the best choice for them. Whether the mechanism of access is open or laparoscopic. We can use different mechanisms to achieve weight loss like restriction, malabsorption, or both ***(3).***

The laparoscopic sleeve gastrectomy (LSG) is an effective surgical technique to treat obesity as the ghrelin producing mass of the stomach is removed. Early LSG researches regarding the super-obese (Body mass index> 60 KG/M2) and the high-risk patients with many diseases that underwent a LSG as the first step operation in the bariatric surgery avoided complications and mortality and lost weight to facilitate the second operation within six months like gastric bypass ***(4).***

However, Nowadays many surgeons doing LSG as it's easier and faster technically and showing great weight loss results compared to other restrictive or

Malabsorptive techniques, with lower complication rate. ***(4)***.

Staple line leakage (1-2%), staple line bleeding (1%) and pulmonary embolism are considered major complications after laparoscopic gastric sleeve. Other complications include too tight stomach or partially twisted. Rare complications including abdominal organs injury such as the spleen, pancreas or intestine ***(5).***

0.2% cases have been reported as the Incidence of mortality after sleeve gastrectomy. Caused by pulmonary embolism, septicemia, pneumonia, heart attack, and stroke (***6***).

Aim of the Work

This is a prospective study to estimate the incidence of early complications after LSG and to highlight our local strategies on how to manage those complications.

Patients and Methods

Study design:

This study is prospective case series that has been conducted at Ain Shams University Hospitals recruiting 300 patients who underwent laparoscopic sleeve gastrectomy between March 2017 and March 2018 with minimal follow up of one month postoperatively. Informed consent has been taken from all patients who accepted to participate in the study. Confidentiality is assured of the personal data and medical information of all patients.

Patients:

Inclusion criteria:

Individuals having BMI>40 kg/m^2 or with BMI around 35-40 kg/m^2 with other co-morbidities as hypertension, diabetes, obstructive sleep apnea.

Exclusion criteria:

Patients with blood disorders and those who underwent previous abdominal surgery.

Methods:

All patients will be subjected to the following

Preoperative Routine preoperative investigations are requested for all patients, including complete blood picture, coagulation profile, liver and kidney function tests, fasting blood sugar and pelviabdominal U/S. Special investigations are requested for patients with specific co-morbidities as pulmonary function tests for patients with manifestations of chronic obstructive airway disease; ECG and echocardiography for patients above the age of 40.

Surgical technique

Step 1:

The position of patient and sites of ports:

The subject is sited in the supine position and after that Trendelenburg position when the ports have been located. Nathanson liver retractor is placed at A 5mm subxiphoid to withdraw the left lateral segment of the liver. we put 4 ports, first12mm superior and left to the umbilicus as camera port, second 12mm port at right midclavicular line for stapling and surgeon right hand, third port at left midclavicular line for stapling and the last one port (5 mm) for the assistant, placed at left anterior axillary line port (Figure 1).

Step 2:

Gastric mobilization; **Create** a window into the omental bursa about 2-4 cm proximal to the pylorus by means of the energy source. Proceeding superiorly in close contact with stomach serosa, seal and divide the omental vessels (figure 2).

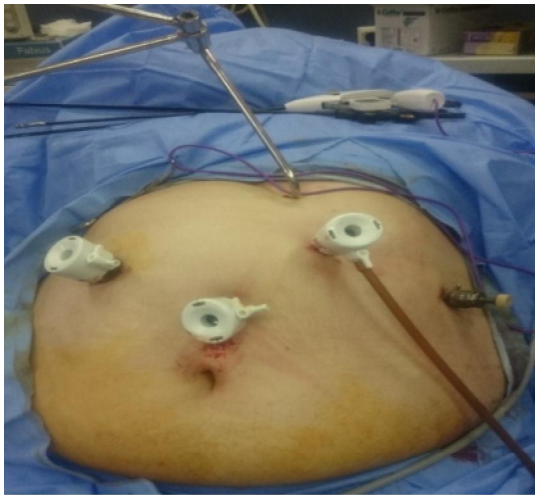


Fig. (1): Port placement in LSG.

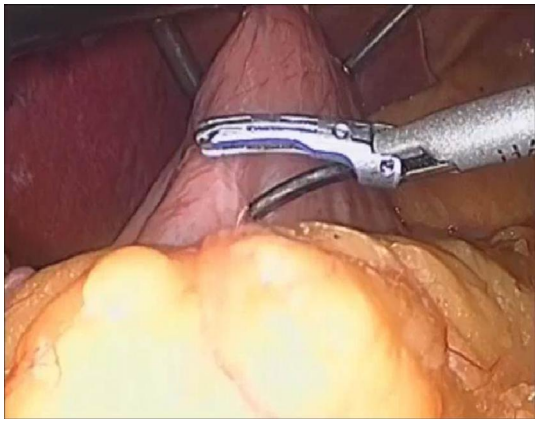


Fig. (2): Mobilization of greater curvature starting from 2-4 cm of pylorus.

Mobilization of the cardia.

It will be easier to withdraw the stomach near the patient's right once the antrum has been moved, and thus inferiorly permitting good coverage of the stomach bed and exposure of pancreas then devascularization of the cardia by sealing and cutting short gastric vessels in close contact to stomach rather

than the spleen to avoid injury of the spleen, we continue dissection of the greater curve up to expose the left crus of the diaphragm completely till the white line as our end point of dissection The anterior fat pad is mostly distended and hinders the vision of the distal esophagus and the medial cardia. Mobilize the anterior fat pad to afford suitable revelation of this region for placement of sutures and optimal stapling. At the end of dissection the stomach should be completely free and freely mobilized to the patient right side by removing congenital adhesion between the stomach and pancreas till complete visualization of posterior lesser curve vessels (Figure 3).

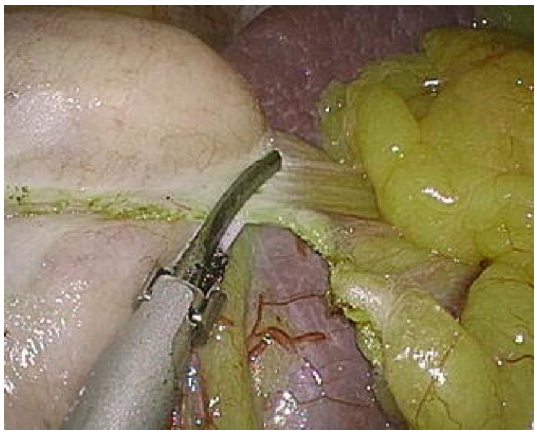


Fig. (3): Mobilization of the cardia.

Step 3:

stapling A36 French orogastric bougie is placed adjacent to the pylorus A 60mm green cartridge is used to staple 2- 4 cm proximal to the pylorus and introduced through the right midclavicular port, The second cartridge 60mm gold colureis in proximity to the incisiora angularis is introduced from the camera port and care must be taken to avoid stenosis here. we then continue stapling of the stomach and The Staple should be equidistant from lesser curve by looking posterior and anterior to avoid twisting of the stomach, Retained fundus occurs if the stomach is not viewed from both anterior and posterior during placement of the stapler.

Engagement of the last two cartridges at the uppermost of the gut can be the more challenging for appropriate calibration. At the pad of fat we should stapling anteriorly outside it and then switch the stomach and the stapler anteriorly to cautiously inspect and withdraw the posterior gastric wall via the cartridge before closing it. Exposure of the left crus verifies the cardia has been well mobilized. The last cartridge must be located 2cm from the gastroesophageal (GE) junction. An intraperitoneal drain was left for 24 hours in all patients.

Postoperative:

All patients were monitored to detect early symptoms subjective to complications such as tachycardia, tachypnea, hypotension and fever. All patients were discharged on the 1st postoperative day after removal of the drain. They started clear oral fluids for 2 weeks and then soft food for the 3rd and 4th weeks. Patients were followed up in the outpatient clinic on weeks 1, 2, 4, and 8.

3. Results

The mean age of our study population is 37.1 ± 20 with gender distribution as 225 for ladies, and 75 for gentlemen. The mean BMI was 41.95 ± 4, with 285 patients (95%) having a BMI between 40-50, while only 15 patients (5%) exceeded BMI of 50. Hypertension was recognized in 30% of patients, DM in 40%, and OSA in only 6%. The average time of operation was 40 ±10 minutes, and hospital stay was averaged 1.2 days (ranging from 1-4 days).

Morbidity and mortality:

There was no mortality detected in this work. The overall rate of complication 30 days post operation was 2.3%. The severity and type of complications are shown in Table 2. Postoperative bleeding was detected in 2 patients (0.6%). One of them was diagnosed by tachycardia, hypotension and drop of hemoglobin level by 2gm/dl. It was managed conservatively by blood transfusion. The other patient was diagnosed by evident bleeding in the drain and tachycardia. It was managed by re-laparoscopy to control the bleeding point, after which postoperative ICU admission was needed for 2 days for monitoring. The results revealed that deep vein thrombosis or pulmonary embolism not recorded in patients presented.

Table (1): Patients' criteria and general data.

Number of patients	300
Age[1] (yr)	37.1 ± 20
Sex (Female/male)	225 / 75
Body Mass Index[1] (kg/m^2)	41.95 ± 4
Body Mass Index< 40 kg/m^2	15 (5%)
Body Mass Index40-50 kg/m^2	285(95%)
Comorbidity	
Hypertension	90 (30%)
Diabetes	120 (40%)
Obstructive sleep apnea (with CPAP)	18 (6%)
Operating time[1] (min)	40 ±10
Hospital stay[1] (d)	1.2 (1-4)

[1]Data are frequency counts (percentage of total) or the mean ± SD plus range in parentheses. CPAP: Continuous positive airway pressure. HTA: Arterial hypertension; BMI: Body mass index.

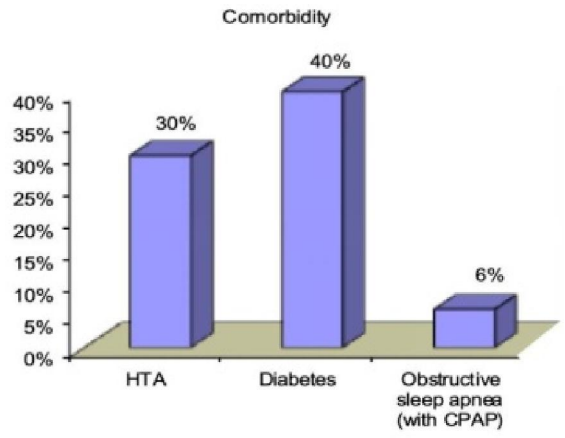


Fig. (4): Patients' percentage of co-morbidities.

Table (2): Mortality and early complications after laparoscopic sleeve gastrectomy (number & percentage (%).

Mortality	**No. (%)**
Total 30-d complications	7 (2.3%)
Staple line leakage	2 (0.6%)
Staple line haemorrhage	2 (0.6%)
Portal vein thrombosis	1 (0.3%)
Wound infection	1 (0.3%)
Chest infection	2 (0.6%)

Two patients (0.6%) after operation complaining from a leakage in the staple-line were identified. An endoprosthesis or self-expanded wall-stent was needed in one patient 17 year old female in the 10th postoperative day, complained of fever, anorexia, and malaise. Then the fever became hectic with tachycardia. Pelviabdominal ultrasound revealed localized intraabdominal collection 4x4.5 cm. Multislice CT of the abdomen and pelvis revealed a localized collection distending the stomach wall and located between the stomach medially and posterior to the left lobe of liver measuring 6x4x4.5 cm with surrounding fat plane haziness (figure6). Percutaneous drainage of the collection was done via pigtail. Upper GI endoscopy was done which revealed defect at site of gastroesophageal junction with introduction of "Megastent" (figure 7). On the 4th day after stent placement, the patient was discharged from the hospital or clinic, and advised to take a liquid food, in addition to antiemetic drugs, a proton pump inhibitor substances, and advices to sleep in a semisitting location. On the 7thday, good flow through the stent was observed by a radiographic examination with contrast medium as an indication for a good position. Diet was developed to soft diets, during the subsequent weeks, in case of the patient not felt with pain, with infrequent biliary vomiting. The patient was readmitted for stent subtraction post 4 weeks. The stent was removed without difficulty. Endoscopic revision confirmed by radiographic examination with contrast medium showed cessation of the leakage. Follow-up visit of the cases after 3 months, the patient was non-symptomatic.

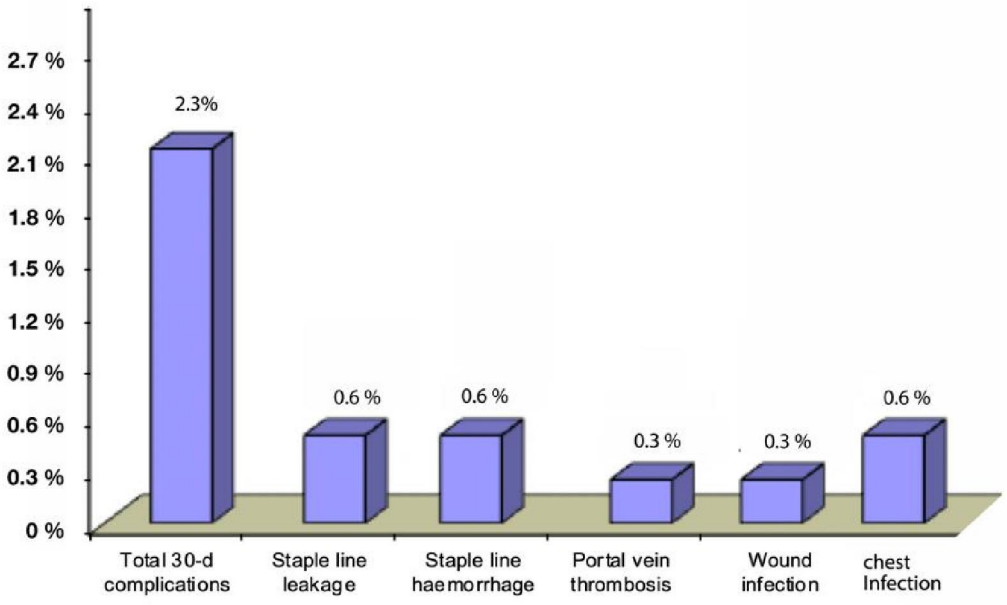


Fig. (5): Percentage of early complications after laparoscopic sleeve gastrectomy n (%).

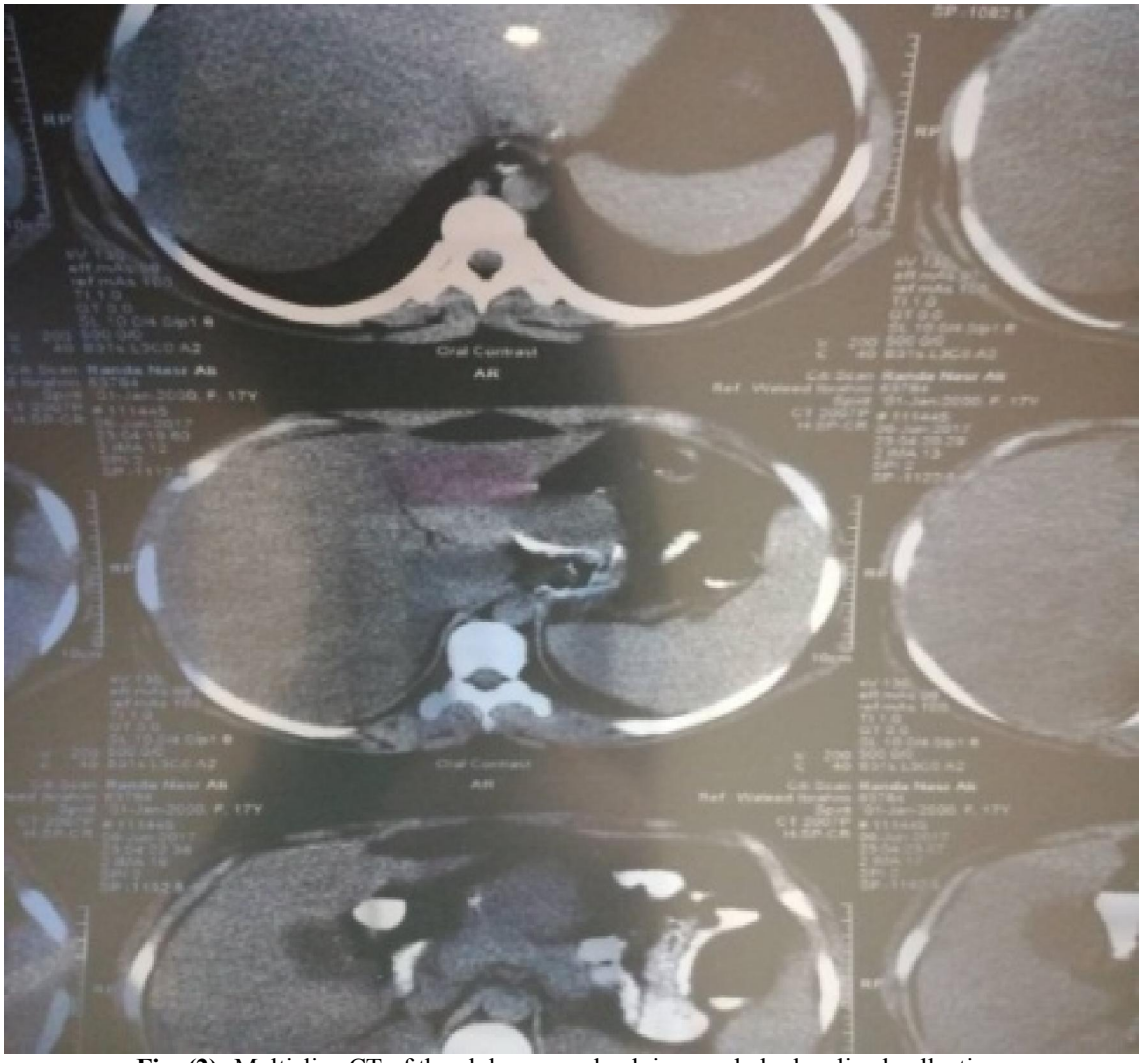
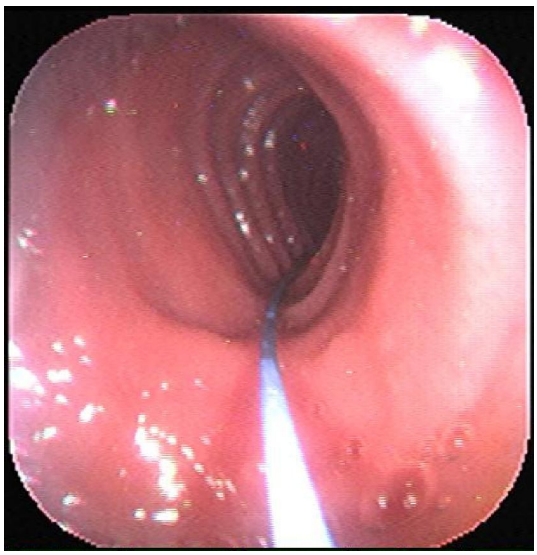
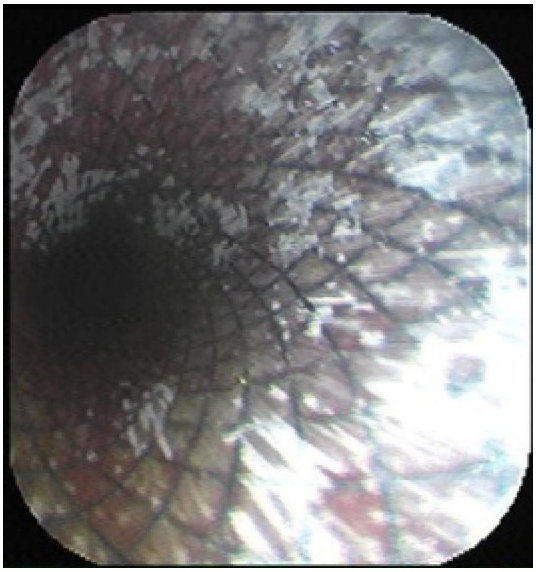


Fig. (2): Multislice CT of the abdomen and pelvis revealed a localized collection.



(A)

(B)



(C)

Fig. (7): Megastent as treatment of post LSG leakage. (A). stent inserted before expansion. (B). stent being expanded. (C). Stent after expansion.

The other patient presented after 3 weeks by hectic fever and vomiting so 3D virtual gastroscopy was done that revealed contained leakage (figure 8A) so internal drainage by double J drain was done by endoscopist with complete drainage of the contained abscess cavity (figure 8B). After that, the patient was followed up for two months as an outpatient, then endoscopist removed double J with complete healing of the leakage.

(A) **(B)**

Figure (8) 3D virtual gastroscopy. (A) contained leakage. (B) internal drainage by double J pigtail.

In our study one patient suffered from mesenteric vein thrombosis (MVT) (0.3%) on 15th day operative. The patient complained of acute severe abdominal pain, nausea, vomiting and low grade fever. However, leukocytosis was obvious. C.T scan was done and revealed a segment of bowel thickening with mural edema and evident mesenteric congestion affecting the jejunal loops at the left iliac fossa (Figure 9). Laparoscopic exploration was done revealed gangrenous proximal jejunum (Figure 10). Abdominal exploration was done with resection of about one meter of proximal jejunum 30 cm distal to duodenojejunal junction (Figure 11). Then, jejunostomy and mucous fistula were done. 2 months later, we did restoration of bowel continuity.

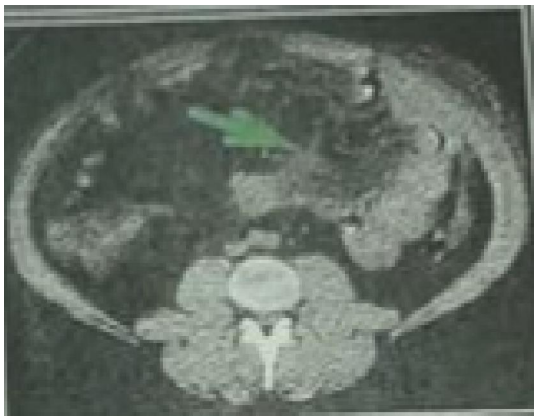


Figure (9) multislice CT scan revealed bowel thickening with mural edema and evident mesenteric congestion

Figure (10) laparoscopic exploration with evident gangrenous jejunal loops.

(A) (B)

Figure (11) Abdominal exploration (A) gangrenous jejunal loop after 30cm. from duodenojejunal junction (B) resection about one meter of the jejunal

4. Discussion

Although LSG is a simple bariatric operation with low rate complications it can be very difficult procedure even for advanced skills laparoscopic surgeons (7).

Nowadays, there is no agreement on the utmost efficient methods to stop the stapler line leak and fistula, while Shikora SA and Mahoney showed that strengthening of the staple line (with sutures or reinforcement material) through laparoscopic sleeve gastrectomy can significantly decrease the incidence of leakage and bleeding ***(8).***

Much debate has recently been raised about the methods for doing stapler line reinforcement. Many researches demonstrated no variations among over stitching of the staple line and the buttresses use. However, by reviewing 8920 patients systematically, it was established that when using absorbable membrane (Seamguard®) (1.1%) the leak rate in LSG was minimal, while it was slightly higher when using over sewing (2.0%), no reinforcement (2.6%), bovine pericardial strip (BPS-Peristrips®) reinforcement (3.3%) and using both sutures and buttressing material (3.6) (9). In our study we didn't use any reinforcement and the leakage rate was 0.6%.

However, an increased risk of tearing and bleeding at the point of suture penetration was recorded by some authors when using over sewing method ***(10).***

As regard bleeding of the suture line Shikora showed that comparable findings were observed with bleeding. The high rate of bleeding was recorded during no support or no reinforcement of the staple lines and the lowest frequency was obtained during reinforcement for the staple lines with bovine pericardium. An intermediate incidence of bleeding was obtained during the use of a glycolide copolymer or suture over sewing ***(8).***

There is widespread debate about the actual real etiology of stapler line leakage but it occurs of the sleeve in the proximal 4 cm or fewer. Contributing factors include tissue ischemia, high pressure system,

poor healing, and suboptimal closure techniques comprising staple malformation, hematoma formation or inappropriate stapler height choice. Blood supplies play an important factor in decisive anastigmatic integrity and staple line. The fragility of the arterial blood supply to the proximal sleeve, was reported by Perez who illustrates the location of nearly all leaks. Specifically, the disruption of the posterior connections of the proximal sleeve may be proposed to interrupt branches of the left gastric artery. It is clear that over dissection of the left crus of the diaphragm devascularise the proximal sleeve with ischemia that lead to increase the rate of leakage (11).

The patient's clinical condition play a significant role in the management of the leak. The patient's status, the duration of the leak, and the resources available must be taken in consideration of the surgeon during management of the operation complications beside a clear treatment strategy or algorithm depending on the above conditions.

Well localized leak with no generalized peritonitis with stable general condition of the patient that represented lately can be managed by ultrasound guided pig tail drainageto relieve the toxemia followed by endoluminal management to promote closure of leak like endoluminal stenting, endoscopic clips or fibrin glue. ***(12).***

In small series of selected cases stenting has been shown to be efficient, but the outcomes can be inconstant subjecting on the duration and size of the leak. In spite of assignment of self-expanding, covered, or incompletely covered stents may be valuable, yet the existing stent technology is not ultimate for such operations. The obstacles represented in the differences of the curvature and the two lumen diameters of the gastric lumen ***(12)***.

The main complication following the procedure is the migration of stent and it has been documented in a range of 20%–59% of patients between diverse series ***(13).***

There are many factors playing a role in enhancing the healing process such as the shape of the proximal part of the stent and its angle with respect to the stent body permitted complete coverage of the leak. The extraluminal collection necessity be sufficiently drained in all cases, and surgical settlement of drains with washout of the infected field is regularly necessary to promote closure of the leak, these procedures must be taken before attempts at stenting. For the reason that successful results post stenting frequently happen in carefully designated patients, confirmation is presently inadequate to make any wide prerogatives that stenting hastens or endorses closure of leaks for all cases. However, stenting may be a valuable therapeutic assistant in some cases and is linked with tolerable risk.

Some authors demonstrated that fluid resuscitation, strict intake and output monitoring with Foley catheter are beneficial methods for acute management of hemorrhage ***(14).*** Sufficient blood transfusion should be given to patient in order to stabilize the level of hemoglobin in the blood. While in haemodynamically stable patients can be controlled conservatively with drain output, serial hemoglobin monitoring and follow up of vital data. Most of the bleeding resulting from post operation stops with conservative management. If there is clinical doubt of an continuing hemorrhage, a CT angiogram can validate hematomas and potentially recognize the bleeding vessel. Angioembolization can be accomplished to control bleeding in case of active hemorrhage ***(15)***.

In the case of intraluminal hemorrhage the patient will require crucial endoscopic intervention – oesophago-gastroduodenoscopy (OGD) particularly inability of patient is to settle on radiology suite. Endoscopic assessment has to be carried out only by a trained bariatric endoscopist, that permits for insertion of clips or injection of adrenaline to stop bleeding if discovered. In the occasion patient was unstable, endoscopic interference should be tried in the operating theatre, and crucial operation can be done when the hemorrhage cannot be stopped by the endoscope ***(15)***.

Urgent re-operation interference are required in case of intra-abdominal hemorrhage, hemodynamic uncertainty permits. Diagnostic laparoscopy is used mainly as an excellent tool to enable direct viewing and to recognize the place of bleeding, in addition to withdrawal of the hematoma and a thorough washout to avoid formation of infection and abscesses formation. In some condition such as noapparentorigin of hemorrhage is recognized it may be suitable to over stitch the entire staple line. Many methods are applied for management of bleeding during the operation such as intraoperative packing (by using gauze) to aid in the control of hemorrhage and permits for hemostasis. Another tool which applied for deceasing the hemorrhage is via increasing abdominal pressure. Moreover, repeated suction and irrigation can assist in knowing the origin of bleeding, and permitting for the use of a clip ***(15)***.

Various techniques have been developed when it comes to preventing bleeding from the staple line. Studies have shown that to reduce the staple bleeding, exposure to compression for 60 seconds instead of 20 seconds is sufficient for stopping of hemorrhage before firing ***(15).***

It is particularly significant to thoroughly check the entire staple line following withdrawal of the bougie. In case of presence of detection of minor bleeding in the place of post-operation, it is simply to

controlled by using small. On the other hand, post-operative hemorrhage may arise from the resected area of the omentum and through using of drains may help in the discovery of such of intra-abdominal bleeding ***(16).***

One of the most complications of the operation is the portal vein thrombosis that includes the portal or mesenteric veins. The portal vein thrombosis is rarely occurred after laparoscopic general surgery, which threatened the life of patient due to mesenteric infarction or ischemia ***(17).*** Clinical symptoms may be delicate and needs a high degree of doubt. In one patient of our series, larger than expected drainage fluid in the postoperative period has represented early ascites and MVT. Approximately 2 weeks post-surgical operation, most patients complaining from nausea, vomiting, generalized abdominal pain, and low-grade fever ***(18).*** Laboratory parameters are normally within normal values; though, leukocytosis and mild increase of liver function tests can too be observed. Therefore, physical examination reslts can be normal, or otherwise, if accompanied with abdominal ischemia, or in some cases with septic shock and peritonitis. In this condition, the patient returned to the hospital with a typical clinical signs of MVT. Conversely, this symptoms is nonspecific, particularly subsequently nausea, vomiting and indefinite abdominal pain, can also be observed for a few weeks in the normal postoperative course of sleeve gastrectomy. Moreover, our patient complained from ascites, which was recognized on CT. The incidence of ascites was nearly 1/3 of patients who existing with MVT, and may be accompanied with retardation in the start of anticoagulation therapy or thrombus resistant to recanalization ***(19).***

The perfect diagnosis of MVT is obtained with non-invasive imagining. The diagnosis can be performed with contrast-enhanced CT or color Doppler ultrasonography. Additional invasive portal venography is usually not required. ***(20).***

Treatment of MVT is directed by the acuity of the illness and the fundamental cause, if identified. Therapeutic anticoagulation is optional in stable, non-cirrhotic patients with acute MVT. The recommended duration of treatment is 6 to 12 months. For subjects with known systemic prothrombotic states, treatment may be continue along the life, with the goal of recanalization of the portal vein ***(21).***

Conclusion

Leakage and hemorrhage after laparoscopic sleeve gastrectomy can be diagnosed clinically rather than laboratory and radiological investigations, which should not delay the decision of immediate surgical intervention if necessary. Mesenteric Venous Thrombosis could be a silent life-threatening complication, therefore, a high index of suspicion is mandatory for early diagnosis, and for commencing immediate and prompt treatment. Further studies are required to establish a consensus on the best treatment modalities for each individual complication.

Conflict of Interest: None to declare.

Financial Support: None to declare.

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