INTERNATIONAL ANATOLIA ACADEMIC ONLINE JOURNAL
e-ISSN 2148-3159 SAĞLIK BİLİMLERİ DERGİSİ REVIEW / DERLEME

# MANAGEMENT OF INTRAOPERATIVE AND EARLY COMPLICATIONS OF SLEEVE GASTRECTOMY

**Hasan ERDEM[1]*, Mehmet GENÇTÜRK[1]**, Serkan BAYIL[1]**, Selim SÖZEN[2]***

*1. İstanbul Obezite Cerrahisi (IOC) Clinic, Kurtköy Ersoy Hospital, İstanbul/ TURKEY*

*2. Sözen Surgery Clinic, İstanbul/ TURKEY*

**Associate Professor of General Surgery*

***Specialist of General Surgery*

| *Geliş Tarihi/Received* | *Kabul Tarihi/Accepted* | *Yayın Tarihi/Published* |
|---|---|---|
| *29-02-2020* | *05-04-2020* | *31-08-2020* |

***Correspondence:*** *Dr. Selim SÖZEN E-mail: selimsozen63@yahoo.com*

***Cite this article as:***
*ERDEM, H , GENÇTÜRK, M , BAYIL, S , SÖZEN, S . (2020). MANAGEMENT OF INTRAOPERATIVE AND EARLY COMPLICATIONS OF SLEEVE GASTRECTOMY. International Anatolia Academic Online Journal Health Sciences, 6 (2), 109-133 . Retrieved from https://dergipark.org.tr/tr/pub/iaaojh/issue/53610/696454*

**ABSTRACT**
The growing prevalence of obesity has become a major concern. The efficacy of medical treatment, diet and behavior therapy in morbidly obese patients is limited. Obesity surgery is a treatment option for selected morbidly obese patients. Sleeve gastrectomy is a serious and irreversible operation involving the removal of the majority of the stomach. The most important complications of this procedure are bleeding and staple line leak. The purpose of the present study is to describe complications, describing treatment and discussing possible underlying mechanisms.

**Keywords:** Sleeve gastrectomy, complications, obesity

# SLEEVE GASTREKTOMİNİN İNTRAOPERATİF VE ERKEN KOMPLİKASYONLARININ YÖNETİMİ

**ÖZET**
Obezite prevalansı gittikçe artan önemli bir sağlık sorunu haline gelmiştir. Obezite için uygulanan tedavilerden; diyet, fiziksel aktivite, davranış terapisi ve kilo verdirici ilaçların etkinliği sınırlıdır. Obezite cerrahisi uygun hasta grubunda seçilebilecek bir yöntem olarak durmaktadır. Sleeve gastrektomi, midenin çoğunun çıkarılmasını içeren ciddi ve geri dönüşü olmayan bir ameliyattır. Bu prosedürün en önemli komplikasyonları kanama ve stapler hattı kaçağıdır. Bu çalışmanın amacı komplikasyonları tanımlamak, tedaviyi tanımlamak ve olası altta yatan mekanizmaları tartışmaktır.

**Anahtar Kelimeler:** Sleeve Gastrektomi, komplikasyonlar, şişmanlık

## INTRODUCTION

Obesity is a serious health problem with increasing prevalence worldwide. It is defined as having a body mass index greater than 30. (1) WHO declares obesity is a chronic disease that does not regress spontaneously and 3.4 million people die due to obesity or being overweight and its comorbidities, for that sould be treated. (1-2). Obesity and related diseases can be treated by bariatric surgery (3). Several procedures are currently available, sleeve gastrectomy which is the one of these procedures, is the most commonly used in North America and Europe (4-6). Ren and collagues performed firstly by laparoscopy at 1999(7). At the time LSG was considered first stage operation to whom applied biliopancreatic diversion or Roux-en-Y gastric bypass (8). Laparoscopic sleeve gastrectomy was subsequently found to be effective as a single procedure for the treatment of morbid obesity (9).

Sleeve gastrectomy, also known as gastric tube surgery or vertical sleeve gastrectomy, is a type of obesity surgery performed in morbidly obese patients with a body mass index of 40 or more. This surgery is a serious and irreversible operation involving the removal of the majority of the stomach. Several complications might occur after sleeve gastrectomy, some of which are unknown. Complications of laparoscopic sleeve gastrectomy are inevitable as with all surgical procedures. It is essential to obtain the necessary and sufficient training and experience and minimise this complication rate by applying the right techniques. In cases of complications, the most crucial factor in reducing patient morbidity and resolving the issue effectively is early recognition of the complication.

### Complications due to the laparoscopic technique

- trocar site bleeding,
- large vessel (aorta, vena cava, iliac artery or vein) injury,
- organ injury (pancreas, spleen, bowels, diaphragm and liver)
- diaphragmatic and oesophageal injuries,
- postoperative wound infection,
- postoperative hernia

### Complications due to sleeve gastrectomy

- staple line leakage,

- staple line bleeding
- stricture of the created tube (stenosis),
- dilatation of the created tube,
- delayed stomach emptying,
- intraperitoneal abscess,
- iatrogenic splenic injury,
- stapler misfiring

**Others**

- splanchnic vessel thrombosis,
- pulmonary embolism,
- portal vein thrombosis (PVT),
- deep vein thrombosis,
- pancreatic trauma and pancreatitis,
- small bowel obstruction

**Complications due to laparoscopic technique**

***Trocar site bleeding***

Trocar site bleeding is due to the presence of a thick abdominal wall due to obesity, the need for a long trocar, increased fat tissue and limited mobility in the instruments. Bleeding from the abdominal wall may not be seen until the trocar is removed because of the tamponade effect on the muscular and subcutaneous bleeding of the trocar (10). For small trocar (5 mm) haemorrhages in obese patients, it may be necessary to enlarge the skin incision to control the bleeding, resulting in more extensive scarring. Different methods and haemostatic agents have been used to prevent this condition. Appropriate Surgicel (Johnson & amp; Johnson Medical, Inc., Arlington, Texas) buffer was recommended to replace the trocar (11). In addition, a Foley catheter replaces the trocar and is inflated, and tamponade can be applied with soft traction. Also, absorbable U-sutures can be placed directly on the abdominal wall under laparoscopic vision. Many specialised tools developed to cover the fascia in the trocar site can also be used for the management of abdominal wall bleeding.

***Large vessel (aorta, vena cava, iliac artery or vein) injury***

A large vessel injury is the primary injury due to laparoscopic technique. When inserting trocar or Veress needle, large vessels (aorta,vena cava,iliac artery or vein) or organs can be injured and this is the most important complication during laparoscopy(Figure 1). The literature reports that the incidence of major blood vessel injury is 0.1%. Intraoperative injury to the portal vein and inferior vena cava is rare but can lead to rapid exsanguinations(12). Champault et al. (13) reported that the rate of major vascular injury was 0.05% in a study that included more than 100,000 patients. In another study by Simforoosh et al. (14) that examined 5347 patients who underwent laparoscopic surgery, only three patients had major vascular injuries (two abdominal aortas and one external iliac vein), all of which were laparoscopically repaired. Nevertheless, our recommendation was an immediate decision to open the abdomen, thereby allowing access to the bleeding site. In addition, the readiness of hospitals in which the surgeries are performed concerning the relevant specialist physician, surgical equipment and intensive care unit conditions to intervene immediately when such complications occur is very important regarding the rapid and successful intervention in these complications.

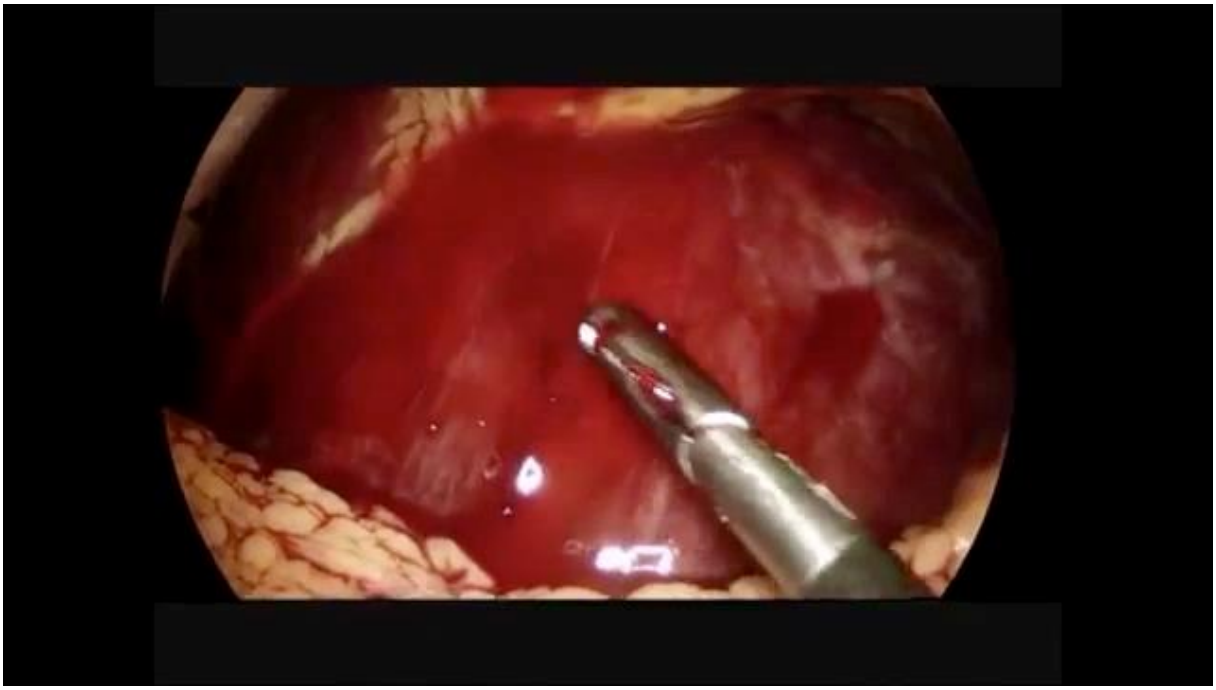


**Figure 1.** A large hematoma (Abdominal aortic injury as a complication of Veress needle inserting.) Archived by Clinic Bariatric İstanbul.

***Organ injury***

Bowel injury is a well-known potential complication since the introduction of laparoscopy. The important thing in this complication is the recognition of the injury. To achieve this, a careful intraabdominal inspection should be performed. It is seen more frequently in patients who have undergone abdominal surgery, such as caesarean section and appendicitis. It develops in 6 out of 10,000 laparoscopy cases on average. Treatment is provided by repairing the injured area during surgery. Usually, the repair process can be performed laparoscopically. In rare cases, traditional open surgery is necessary to treat these injuries. Instruments used in solid organ injuries are encountered because of the retractors and trocars.

Chandler and colleagues in their study of abdominal injuries reported the following:

- Small intestine 25%
- Iliac artery 19%
- Colon 12%
- Iliac and other retroperitoneal veins 9%
- Mesenteric artery 7%
- Aorta 6%
- Inferior vena cava 4%
- Abdominal wall vessels 4%
- Bladder 3%
- Liver 2%
- Other 2%

They were sequenced (15). As can be seen from this study, solid organ injury is less common than other injuries. Particularly in patients with advanced liver fat, minor liver injuries may often develop due to exclusion. Often no treatment is required.

***Splenic Injuries***

Generally, splenic injury occurs when body mass index values are very high, abdominal fat tissue is high and in cases of poor preoperative diet that may develop improperly due to

insufficient imaging. Treatment is applied according to the degree of injury. Minor injuries can be treated with an argon laser and various coagulants. In the worst case, the spleen may need to be removed if the bleeding cannot be stopped or if the spleen has an injury that is impossible to treat.

### *Diaphragmatic and oesophageal injuries*

These injuries usually result from the use of energy devices and staplers. An iatrogenic oesophageal process can be averted by the routine use of a bougie or calibration tube. Also, to prevent these injuries, the fundus should be completely dissected to the angle and the left crus of the diaphragm before the sequential stapling process. This may also contribute to the protection of the oesophagus and the leak of the gastro-oesophageal junction. There should be a low threshold for conversion. This is one of the basic principles of safe laparoscopic surgery. If oesophageal transection is detected, a two-stage approach is recommended. In the first stage, oesophageal injury assessment, thoracic and abdominal drainage and feeding jejunostomy tubes are applied. In the second stage, restoration of oesophagogastric or oesophagoenteric continuity is ensured (16).

### *Postoperative wound infection*

In a multicentre study conducted by Nguyen et al. (17), the most common complications were wound infections (2.6%), pneumonia (1.9%), and the third most frequent were cardiac arrhythmias (1.7%). Microorganisms responsible for the infection are usually dependent on the operative field and surgical procedure. The sources of pathogens are endogenous flora, often originating from the patient's skin, mucous membranes, or the intestinal tract (18). Prophylactic antibiotic use has been proven to prevent surgical site infections. The application of a flawless surgical technique significantly reduces surgical site infections.

Furthermore, prolongation of the operation time increases the possibility of surgical site infection. Increased number of microorganisms contaminating the wound because of prolongation of time, increased tissue damage, increased suppression of host defence mechanisms and increased fatigue in the operation team may result in more disruptions in aseptic techniques (19). Therefore, knowing all the risk factors that cause surgical site infections and taking necessary precautions will decrease the incidence of these infections.

***Postoperative hernia***

Wound hernia may develop in 15% of cases. The treatment of these swellings outside the abdomen requires a second operation. Port site hernias can develop as early as two days after laparoscopic surgery and may cause intestinal obstruction (20). In general (non*obese) population, trocar port hernias are rare and its incidence in literature is 0.5%-2%(21). Trocar site hernias are of the early-onset type, late-onset type and mixed type. Of these, the early-onset type (type 1), the fascia and peritoneum were opened anteriorly and posteriorly. In the late-onset type (type 2), the peritoneal hernia sac is seen. In the mixed type 3, herniation involves all of the abdominal wall or organs and the mesentery (22). It is called early cases in cases diagnosed within the first 3-5 days of trocar site herniation. Such herniations are not hernias, but rather hernias due to inadequate closure. The hernias seen months after the surgery are real hernia and hernia sacs are present. Trocar port hernias which are seen early after surgery, are important because of presenting with intestinal or omental strangulation. To prevent bowel ischemia prompt recognition is important. Herniated organ can be seen easily by contrasted Computed Tomography (CT) (23-25). It is generally recommended that 10 mm or larger port sites are closed at the end of laparoscopic procedures (26,27) (**Figure 2**). However, trocar site hernias should always be kept in mind in mechanical intestinal obstruction that may develop early or late after laparoscopic surgery. Treatment (Herniated organ) predominantly consists of a reduction under general anaesthesia. In these cases, laparoscopic bowel inspection is advised.

**Figure 2.** Trocar site closure device, Archived by Clinic Bariatric İstanbul.

**Complications due to sleeve gastrectomy**

Bleeding, bowel perforation, diaphragmatic injury, injuries to other adjacent organs especially posterior surface of the stomach and anterior pancreatic surface are complications of sleeve gastrectomy during procedural (intraoperative) procedures.

Gastric leakage, haemorrhage, abscess splenic infarction and acute pancreatitis are early complications which seen within two weeks. Stricture formation, nutritional deficiency, GERD, port site hernia are delayed complications which are seen after two weeks (28).

**Intraoperative complications**

***Stapler line leaks***

Stapler line leaks are one of the serious life-threatening complications after LSG. It is the most frequent complication (<1%) and one that determines morbidity and mortality rates in this type of surgery (29). Most leaks occur below the gastroesophageal junction (1.5%) (**Figure 3** ). They are less frequent in the inferior segment of the gastric sleeve (0.5%) (29-32).

Early detection of leakage is important to decrease the mortality rate which is between 1% to 10%. If not detected, it leads to abcess, peritonitis, sepsis and multiorgan failure (33,34). Physical examination, inflammatory parameters and computed tomography are used to detect anastomotic leakage (35,36).

CRP is an inflammatory marker commonly used in the diagnosis of intraabdominal infections which has a sensitivity of 74% and specifity of 75% (37).

**Classification of gastric leaks**

Gastric leaks are classified due to the time of appearance after surgery, clinical severity and location of leaks which are proposed by Csendes et al. and Burgos et al. (38-40).

Based on clinical presentation, gastric leaks were classified as follows:

Type I (Subclinical): Presence of leakage without early septic complications corresponding to drainage through a fistulous track and/or without generalised dissemination to the pleural or abdominal cavity with or without the appearance of contrast medium in any of the abdominal drains.

Type II (Clinical): Presence of leakage with early septic complications corresponding to drainage by an irregular pathway (no well-formed fistulous tract) and more generalised dissemination into the pleural or abdominal cavity with or without the appearance of contrast medium in any of the abdominal drains.

Clinical examinations must include the following: General examination, including vital data (pulse, temperature, blood pressure and respiratory rate); General condition of the patient (manifestation of toxicity, sepsis or shock); Local examination, which is not dependable in obese patients (tenderness, the rigidity of the abdomen or rebound tenderness); Drainage, the amount of collected fluid and its characteristics; The investigation, including laboratory [complete blood count, liver function test, kidney function test, coagulation profile, blood sugar test and arterial blood gases]; and radiological investigation, (abdominopelvic ultrasound, chest radiograph, gastrografin study and, most importantly, the CT of the abdomen and pelvis with oral and intravenous contrast).

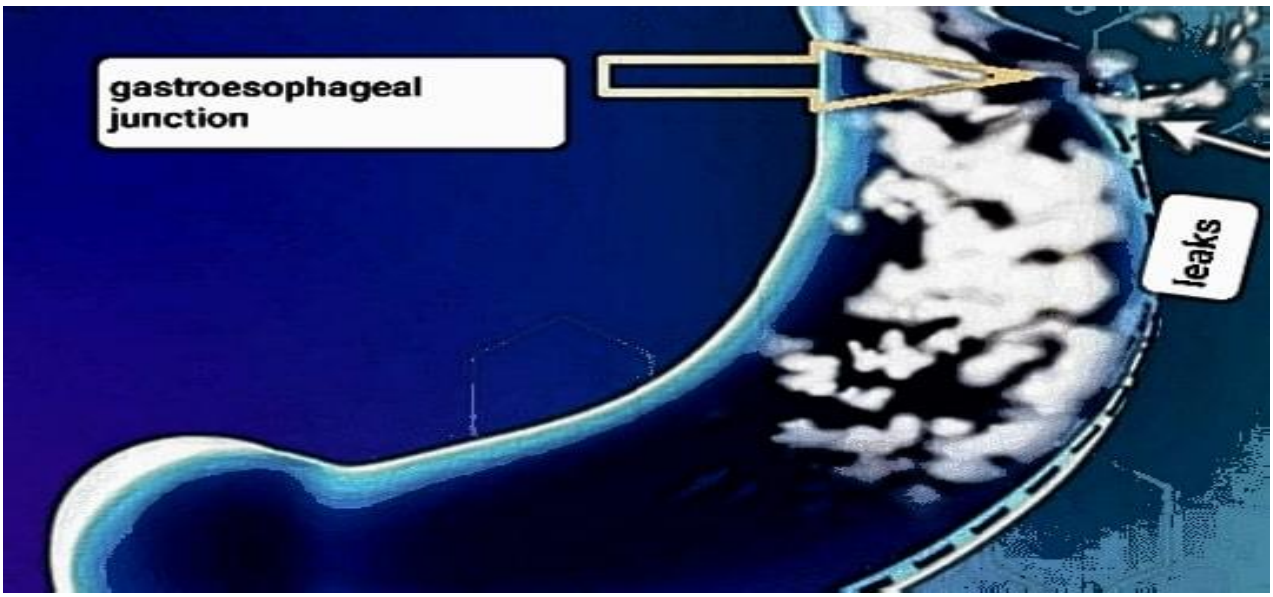



**Figure 3.** Stapler line leaks, Archived by Clinic Bariatric İstanbul.

## TREATMENTS

Treatment options depend on the clinical scenario and may range from intravenous antibiotics and nutritional support to surgical procedures, such as Roux-en Y oesophagojejunostomy or gastrectomy with fistulojejunostomy, and endoscopic procedures, including stenting. Sepsis control and nutritional support are the cornerstones of management. We do not recommend

fistula loop jejunostomy because it does not direct bile flow and can complex the fistula. Many series reported the successful use of pigtail drainage in these patients, considering it a good option in contained leaks (41). Also, as an endoscopic method, the longer covered self-expanding metallic oesophageal stent that is specifically designed for post-sleeve leaks (Mega stent) may be used (**Figure 4**). The upper side of stent is located near the middle of oesophagus and distal part in the antrum or the first part of duodenum. As this stent close the leakage part, also possibly play a role in decompression of the stomach by reducing intra-gastric pressure. Expandable stents reduce intra-gastric pressure, close the recovery area and accelerate healing (42). The stent provides a temporary seal of the leak while also allowing oral intake during the process of healing. Oral intake during healing continues and by the side, stents may also correct sleeve axis in cases of gastric torsion or twist (43). Complications include stent migration, hematemesis, erosion and granulation overgrowth, which leads to obstruction (44). The type and diameter of the selected stent are also important. Usually, the use of metal stents that are fully covered and as wide as possible are recommended. Plastic stents are not recommended because of difficulties in placement and high rates of migration (45).

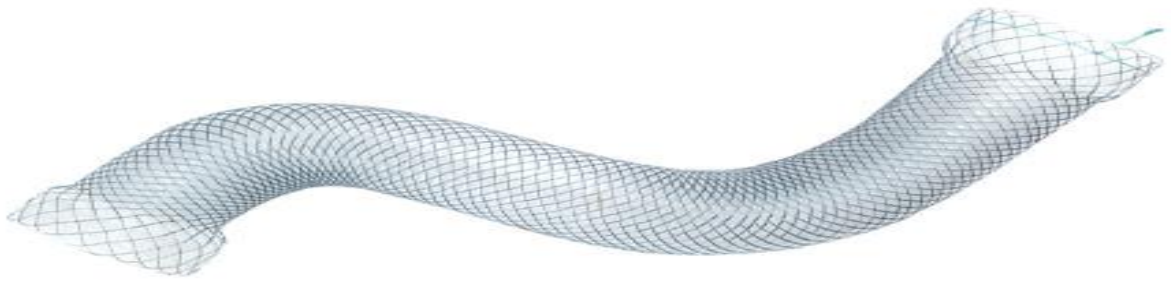


**Figure 4.** Mega stent, Archived by Clinic Bariatric İstanbul.

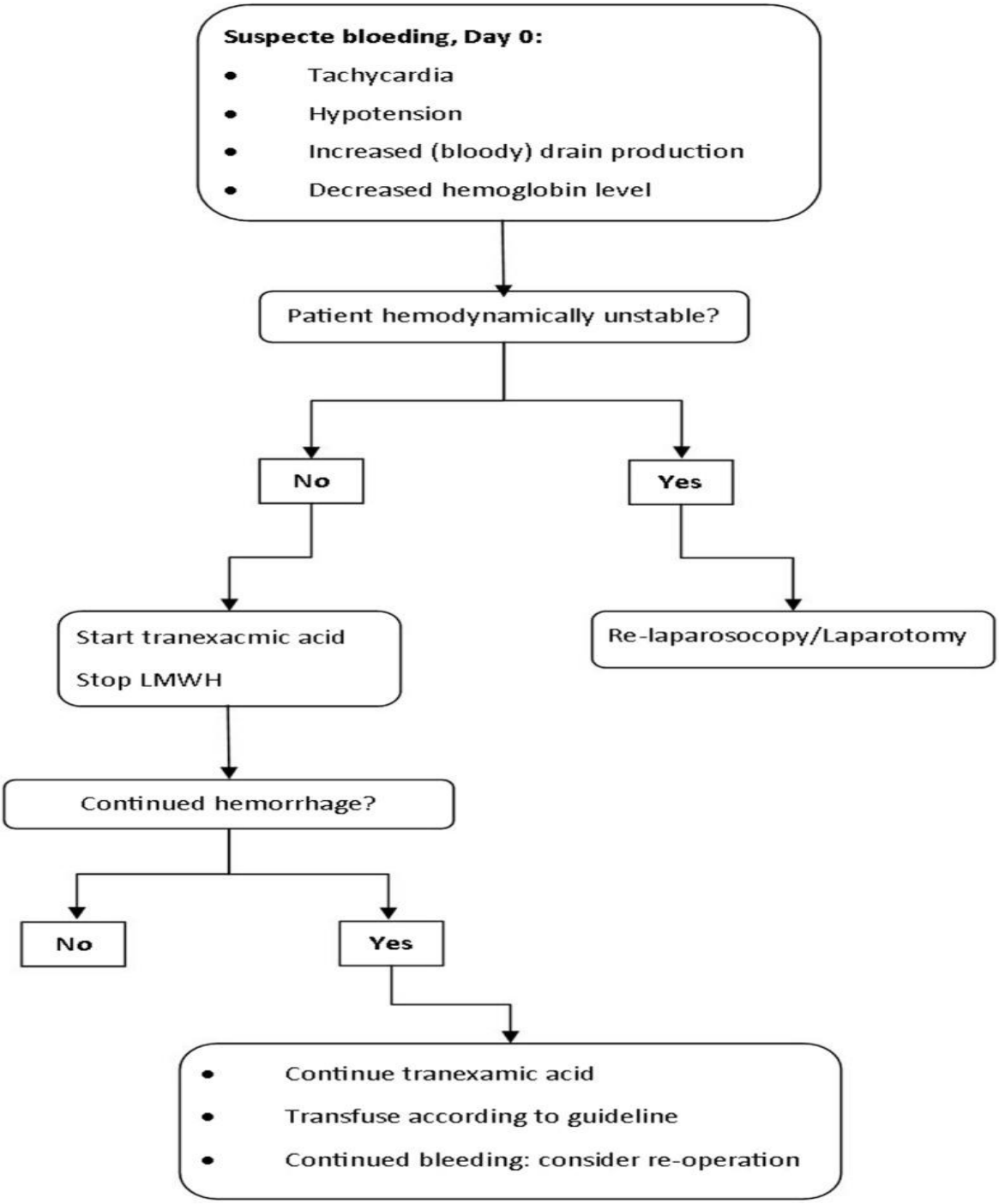
There is no consensus on the time interval between stent placement and removal in the literature. However, removal of the stent between 6-8 weeks is ideal (46). Removal of the stent at a later period may be difficult due to fibrosis (47). Early removal of the stent does not allow the fistula tract to heal, whereas late removal leads to difficulties in the removal of the stent. Another endoscopic method is clip application. Dakwar et al. (48) have reported successful management of LSG leaks with a 10-mm over-the-scope metallic clip (**Figure 5**). The success rate of this method is low in large perforations.

**Figure 5.** A metallic clip, Archived by Clinic Bariatric İstanbul.

In contrast, Abbas et al. reported that a metallic clip failed to close a fistula in one of two patients in whom they applied metallic clips. They performed a mega stent in the failed case. The success rate of clip application is low in patients with wide fistulas.

***Bleeding***

Within 12-48 hours after the, bleeding can be occurred and is the most common and early complication (49). The staple line is the most common site of bleeding after an SG, but the omentum, mesentery and spleen are also potential areas (**Figure 6**). Various technical modifications, such as the application of haemostatic agents on staple lines, have been described to decrease the incidence of postoperative bleeding (50). A number of buttressing materials are commercially available to attempt to reduce the rate of bleeding from the staple line. These are glycolide trimethylene carbonate copolymer (Gore Seamguard W.L:Gore and Associates), bovine pericardium strips (Synovis Surgical İnnovations) or porcine small intestiubmucosa (Surgisis Biodesign Cook Medical). Also tranexamic acid may be used to reduce the bleeding. Klaassen et al recommend a treatment algorithm for management of patients with postoperative bleeding. (51).


Suspecte bloeding, Day 0:
Tachycardia
Hypotension
Increased (bloody) drain production
Decreased hemoglobin level
Patient hemodynamically unstable?
No
Yes
Start tranexacmic acid
Stop LMWH
Re-laparosocopy/Laparotomy
Continued hemorrhage?
No
Yes
Continue tranexamic acid
Transfuse according to guideline
Continued bleeding: consider re-operation

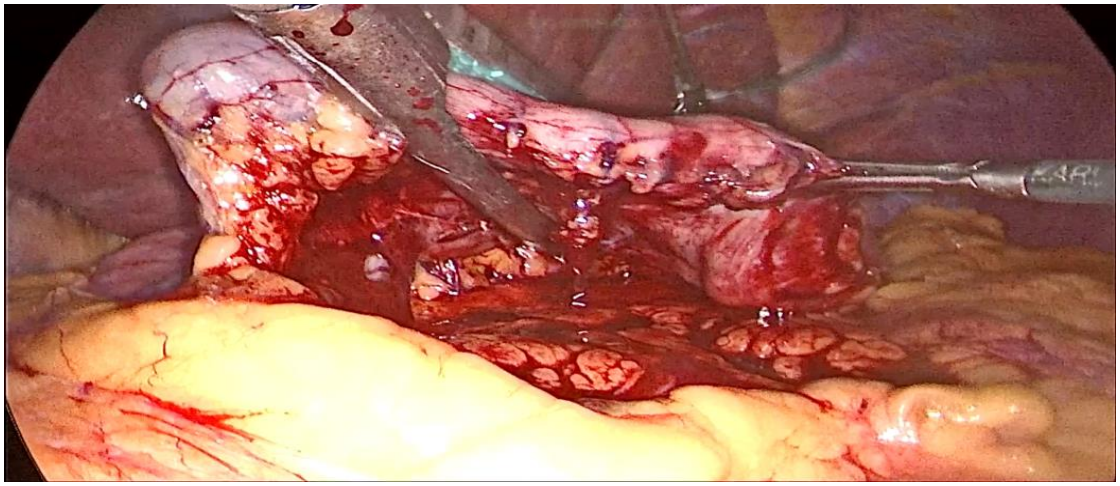


**Figure 6.** Bleeding from gastroepiploic vessels, Archived by Clinic Bariatric İstanbul.

***Stenosis***

Stenosis of the sleeve is a serious complication after LSG which leads to persistent nausea, vomiting and food intolerance. It occurs in 0.6%to4% after LSG (52-56). Most stenoses were located in the proximal or distal third of the sleeve, with fewer than 10% in the middle third. (55-59) (**Figure 7**) Oedema, ischemia, torsion, kinking or scarring of the sleeve along the staple line are the reason of the stenosis (60-63). Stenosis can be classified into two categories: acute and chronic. Acute stenosis can be caused by mucosal oedema and kinking. Chronic stenosis is related to ischaemia of the pouch and retraction due to scarring.


**Figure 7. Stenotic area, Archived by Clinic Bariatric İstanbul.**

**TREATMENTS**

Short stenosis can be treated with endoscopic balloon dilation in single or multiple sessions (64). Eubanks et al. (65) reported the use of endoscopic silicone-covered stents to treat strictures. The stent allows oral feeding immediately, but the primary morbidity is stent migration. Per-oral endoscopic myotomy which is named endoscopic tunnelled stricturotomy is also a new and another technique. This new endoscopic tunnelled stricturotomy technique is performed in four steps: (1) identification of the precise location of the stenosis, (2) a submucosal injection approximately 5 cm before the stenotic area, (3) submucosal tunnelling of the stricturotomy and (4) closure (66). Regarding surgical treatment, the best possible treatment choice is conversion to a Roux-en-Y gastric bypass. Sudan et al. (67) described the stricturoplasty, where the strictire was incised along the longitudinal axis, incorporating the entire length of the stricture. The incision was then closed in the transverse axis in a single layer with permanent suture, resulting in a wider lumen, using the principles of the Heineke-Miculicz technique. Dapri et al. (58) have reported another surgical procedure for long stenosis-laparoscopic seromyotomy. It involves the cutting of the tunica serosa and muscularis propria until the submucosa about one cm from the stenosis, as in the treatment of oesophageal achalasia (**Figure 8**). Recently, some authors have suggested a laparoscopic median gastrectomy with resection of the stenotic segment. Laparoscopic median gastrectomy is a feasible and effective option in patients who have failed conservative management of stenosis after LSG, and in whom there is a desire to avoid seromyotomy or conversion to gastric bypass (68) (**Figure 9**).

**Figure 8.** Seromyotomy, Archived by Clinic Bariatric İstanbul.

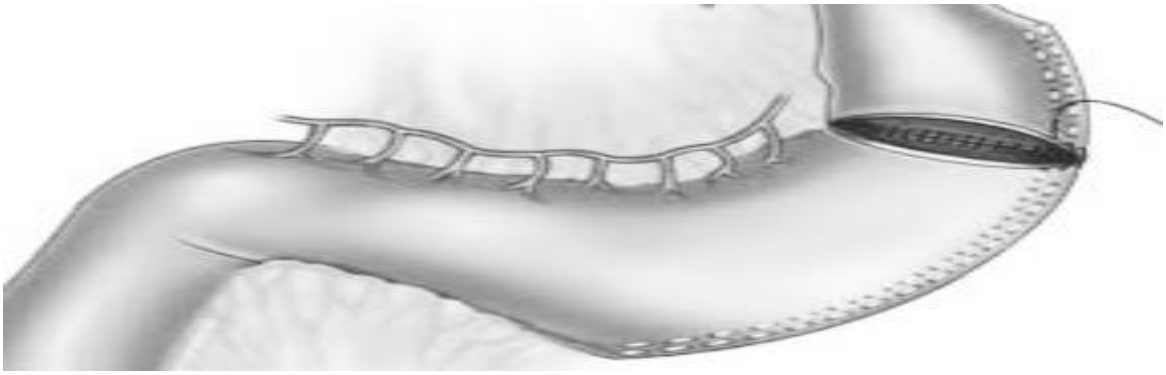


**Figure 9.** Laparoscopic median gastrectomy, Archived by Clinic Bariatric İstanbul.

***Splenic ischaemia***

LSG requires mobilisation of the gastric fundus and division of short gastric vasculature. Thus, upper pole ischaemia and necrosis may be observed. Physiologically, the splenic segmental arteries are terminal arteries without any collateral circulation. Therefore, closure of a segmental artery usually leads to infarction of the vascularised splenic segment or splenic pole (69,70). The incidence of splenic infarction is unknown due to LSG. CT scan remains the gold standard for definitive diagnosis (71). CT angiography investigates the extent of splenic infarction (72). Patients with partial splenic infarcts have an asymptomatic or mildly symptomatic course. Conservative management includes specifically antibiotics, analgesia, intravenous fluids and anticoagulation. Sometimes, a splenic infarct undergoes fibrosis of the malperfused segment or leads to complications, such as the development of a haematoma, splenic rupture, abscess or pseudocyst formation (73). Development of a haemotoma, splenic rupture, abcess or pseudocyst formation due to splenic infarct are treated best with surgical procedures. However partial or total splenectomy in these patients is controversial (74,75).

***Portal thrombosis and venous thromboembolism***

Obese patients requiring bariatric surgery are at increased risk for venous thromboembolism VTE. The underlying inflammatory, hypercoagulable states and metabolic syndrome may predispose to VTE (76,77). PVT has been described as a condition stemming from the abnormal development of a thrombus in the extrahepatic portion of the portal vein resulting in total or near-total obstruction. Direct surgical manipulation of portomesenteric vessels predispose to venous thrombosis as in splenectomy. Sleeve gastrectomy involves transection of

the short gastric veins alone. Although skeletonisation of the greater curvature by dividing the left gastroepiploic arcade and short gastric vessels may encourage change in venous blood flow from the stomach, infarction or ischaemia in the upper pole of the spleen occurs occasionally causing the release of inflammatory mediators (78,79). In addition, the damage of the splanchnic endothelium may trigger local thrombus formation that may lead to portomesenteric venous thrombosis (PMVT) (80,81). Genetic coagulopathies that have been associated with PMVT (82). PMVT is a disease that lacks specific symptoms, and ranges from mild abdominal pain and vomiting to severe manifestations such as hematemesis, bloody diarrhoea, and back pain. It could also be asymptomatic.

A contrast-enhanced abdomen and pelvis CT is choice in the diagnosis of portal thrombosis due to its sensitivity approaches 90% (83). Uncomplicated cases are usually managed conservatively with anticoagulants and thrombolytics that are thoroughly effective and are considered as the main therapeutic options. Thus, we recommend that patients who undergo bariatric surgery be kept on anticoagulants for at least 10 days beyond hospital discharge and remain well hydrated. The suggested duration of PMVT treatment is 6 to 12 months. For patients with known systemic prothrombotic states, treatment may be lifelong, with the goal of recanalisation of the portal vein (84). In patients presenting with peritonitis or shock, an exploratory laparotomy is required with possible resection of the necrotic bowel.

***Pancreatic trauma and Pancreatitis***

Pancreatitis has been rarely reported in the literature as an early complication of bariatric surgery (85). The most probable cause of acute pancreatitis as an early complication is secondary to severe adhesion of peripancreatic tissue intraoperatively. Other mechanisms could be due to compromised pancreatic microcirculation following gastrectomy or oedema and spasm of the major papilla (86). Another cause of postoperative pancreatitis may be drugs used by patients. Among these, corticosteroids and calcium are prominent. The risk of complications and mortality rates in postoperative pancreatitis are higher than other forms of the disease. An important reason for this is that the diagnosis can easily be overlooked. Especially in abdominal surgery, incision pain can be confused with pancreatic abdominal pain and postoperative analgesia and paralytic ileus may mask the symptoms of real disease. Standard treatment in all patients includes intravenous fluid resuscitation, electrolyte

replacement and analgesic therapy. Total parenteral nutrition (TPN) is used for nutritional support of the patient, antibiotherapy is used to prevent septic complications, and respiratory support is used to prevent hypoxia in patients with respiratory distress. In acute pancreatitis, massive fluid sequestration occurs. Therefore, initial treatment should be directed at correcting hypovolemia. Ensuring adequate volume can be controlled by heart rate, arterial blood pressure and urine output.

During acute pancreatitis, hypochloraemia, hypokalaemia and hypocalcaemia may occur and NaCl, KCl, and Ca replacement should be performed, respectively. An important part of the treatment of acute pancreatitis is pain therapy. Pain increases the pancreatic secretions by stimulating the central nervous system. Meperidine should be preferred since morphine, and similar opium derivatives increase the pressure in the sphincter of Oddi (87).

Pancreatic fistula is seen after as pancreatic disorders and trauma due to pancreatic surgery, abdominal trauma, percutaneous radiologic procedures as surgery involving adjacent organs such LSG (88,89). The drain on a major curvature provide drain leakage so prevent fluid accumulation and development of peritonitis If a PF is considered, amylase and lipase values from the drain can be checked. If the drain amylase level led us to believe that the patient had a PF, octreotide, a somatostatin analogue, was started at a subcutaneous dosage of 3 × 0.1 mg/mL(90). In addition, intravenous medication consists of 3500 cc/day of TPN, 40 mg/day omeprazole and 60 mEq/day KCl, which must be given until oral intake is started.

## REFERENCES

1. Global status report on noncommunicable diseases 2014. “Attaining the nine global noncommunicable diseases targets; a shared responsibility”. World Health Organization, Geneva 2014.
2. World Health Organization. Obesity and Overweight: fact sheet [online]. Available at: http://www.who.int/mediacentre/factsheets/fs311/en/. Accessed January 11, 2016.
3. Buchwald H, Yoav A, Braunwald E, et al. Bariatric surgery a systematic review and meta-analysis. JAMA 204; 292: 1724-37.
4. Angrisani L, Santonicola A, Iovino P, et al. Bariatric surgery worldwide 2013. Obes Surg 2015; 25: 1822-32.

5. Janik M, Stanowski E, Paśnik K. Present status of bariatric surgery in Poland. Videosurgery Miniinv 2016; 11: 22-5.
6. Walędziak M, Rożańska-Walędziak A, Kowalewski P, et al. Present trends in bariatric surgery in Poland. Videosurgery Miniinv in press; DOI:10.5114/wiitm.2018.77707.
7. Ren CJ, Patterson E, Gagner M. Early results of laparoscopic biliopancreatic diversion with duodenal switch: a case series of 40 consecutive patients. Obes Surg. 2000;10:514–23. [PubMed] [Google Scholar]
8. Regan JP, Inabnet WB, Gagner M, et al. Early experience with two-stage laparoscopic Roux-en-Y gastric bypass as an alternative in the super-super obese patient. Obes Surg. 2003;13:861–4. [PubMed] [Google Scholar]
9. . Moon Han S, Kim WW, Oh JH. Results of laparoscopic sleeve gastrectomy (LSG) at 1 year in morbidly obese Korean patients. Obes Surg. 2005;15:1469–75. [PubMed] [Google Scholar]
10. Karthik S, Augustine AJ, Shibumon MM, Pai MV. Analysis of laparoscopic port site complications: A descriptive study. J Minim Access Surg. 2013;9:59-64.
11. Malik AM, Laghari AA, Mallah Q, Hashmi F, Sheikh U, Talpur KA. Extra-biliary complications during laparoscopic cholecystectomy: How serious is the problem? J Minim Access Surg. 2008;4:5-8.
12. Lim RB, Jones D, Chen W. Bariatric Operations: Perioperative Morbidity and Mortality. URL: www. uptodate.com/contents/bariatric-operationsperioperative-morbidity-and-mortality (accessed April 2016).
13. Champault G, Cazacu F, Taffinder N. Serious trocar accidents in laparoscopic surgery: a French survey of 103,852 operations. Surg Laparosc Endosc 1996;6:367-70.
14. Simforoosh N, Basiri A, Ziaee SA, Tabibi A, Nouralizadeh A, Radfar MH, et al. Major vascular injury in laparoscopic urology. JSLS 2014;18.
15. Chandler JG, Corson SL, Way LW. Three spectra of laparoscopic entry access injuries. J Am Coll Surg. 2001 Apr;192(4):478-90; discussion 490-1.
16. Meshikhes AW, Al-Saif OH. Iatrogenic oesophageal transection during laparoscopic sleeve gastrectomy. BMJ Case Rep. 2014 Mar 3;2014. pii: bcr2013201260. doi: 10.1136/bcr-2013-201260.
17. Nguyen NT, Silver M, Robinson M, Needleman B, Hartley G, Cooney R, Catalano R, Dostal J, Sama D, Blankenship J, Burg K, Stemmer E, Wilson SE. Result of a national

audit of bariatric surgery performed at academic centers: a 2004 University HealthSystem Consortium Benchmarking Project. Arch Surg 2006;141(5):445-9.

18. Nathens AB, Dellinger EP. Surgical site infections. Current Treatment Options in Infectious Diseases 2000; 2: 347-358.
19. Mangram AJ, Horan TC, Pearson ML, Silver LJ, Jarvis WR Guideline for prevention of surgical site infection,1999. AJIC 1999; 27:97-134.
20. Sharma R, Mehta D, Goyal M, Gupta S. The earliest presenting umbilical port site hernia following laparoscopic cholecystectomy: a case report. J Clin Diagn Res 2016;10:PD18–9.
21. Molloy D, Kaloo PD, Cooper M, et al. Laparoscopic entry: a literature review and analysis of techniques and complications of primary port entry. Aust N Z J Obstet Gynaecol. 2002;42:246–54.
22. Buhaskar K. Trocar site hernia.World J Surg 2009;2:27-29.
23. Lee JH, Kim W. Strangulated small bowel hernia through the port site. a case report. World J Gastroenterol 2008;14:6881-3.
24. Cottam DR, Gorecki PJ, Curvelo M, et al. Preperitoneal herniation into a laparoscopic port site without a fascial defect. Obes Surg 2002;12:121-23.
25. Wagner M, Farley GE. Incarcerated hernia with intestinal obstruction after laparoscopic cholecystectomy. Wis Med J 1994;93:169-71.
26. Tonouchi H, Ohmori Y, Kobayashi M, Kusunoki M. Trocar site hernia. Arch Surg 2004;139:1248–56. [CrossRef].
27. Ece I, Yilmaz H, Alptekin H, Yormaz S, Colak B, Sahin M. Port site hernia after laparoscopic sleeve gastrectomy: a retrospective cohort study of 352 patients. Updates Surg 2018;70:91–5. [CrossRef].
28. Rocha, V.Z.; Libby, P. Obesity, inflammation, and atherosclerosis. Nat. Rev. Cardiol. 2009, 6, 399–409.
29. Chivot C, Lafaye N, et al. Laparoscopic sleeve gastrectomy: Imaging of normal anatomic features and postoperative gastrointestinal complications. Diagn Interv Imaging. 2013; 94: 823-34.
30. Levine M, Carussi L. Imaging of bariatric surgery: normal anatomy and postoperative complications. Radiology Feb 2014, 270(2):327- 41.
31. Criterios de inclusión y exclusión para cirugía bariátrica: decisión de equipo o individual. Conferencia presentada en el III Congreso de Nutrición Clínica y Metabolismo, Santiago,

18-20 de abril de 2002. http://www.medwave.cl/link.cgi/Medwave/Puestadia/Congresos/1209.

32. Pérez D, Schiappacasse G, Zúñiga F. et al. Gastrectomía en manga: Estudio por imagen de sus complicaciones. Rev Chil Cir. Oct. 2015; 67(5): 554-559.
33. Lalor PF, Tucker ON, Szomstein S, Rosenthal RJ. Complications after laparoscopic sleeve gastrectomy. Surg Obes Relat Dis. 2008;4:33-8.
34. Gonzalez R, Sarr MG, Smith CD, Baghai M, Kendrick M, Szomstein S. et al. Diagnosis and contemporary management of anastomotic leaks after gastric bypass for obesity. J Am Coll Surg. 2007;204:47-55.
35. Carucci LR1, Turner MA, Conklin RC, DeMaria EJ, Kellum JM, Sugerman HJ. Roux-en-Y gastric bypass surgery for morbid obesity: evaluation of postoperative extraluminal leaks with upper gastrointestinal series. Radiology. 2006;238:119-27.
36. Walsh C, Karmali S. Endoscopic management of bariatric complications: A review and update. World J Gastrointest Endosc. 2015;7:518-23.
37. Platt JJ, Ramanathan ML, Crosbie RA, Anderson JH, McKee RF, Horgan PG, et al. C-reactive protein as a predictor of postoperative infective complications after curative resection in patients with colorectal cancer. Ann Surg Oncol. 2012;19:4168-77.
38. Csendes A, Díaz JC, Burdiles P, Braghetto I, Maluenda F, Nava O, et al. Classification and treatment of anastomotic leakage after extended total gastrectomy in gastric carcinoma. Hepatogastroenterology. 1990;37(Suppl 2):174–7. [PubMed] [Google Scholar].
39. Csendes A, Burdiles P, Burgos AM, Maluenda F, Diaz JC. Conservative management of anastomotic leaks after 557 open gastric bypasses. Obes Surg. 2005;15:1252–6. [PubMed] [Google Scholar].
40. Burgos AM, Braghetto I, Csendes A, Maluenda F, Korn O, Yarmuch J, et al. Gastric leak after laparoscopic-sleeve gastrectomy for obesity. Obes Surg. 2009;19:1672–7. [PubMed] [Google Scholar].
41. Casella G, Soricelli E, Rizzello M, Trentino P, Fiocca F, Fantini A, et al. Nonsurgical treatment of staple line leaks after laparoscopic sleeve gastrectomy. Obes Surg. 2009;19:821–6. [PubMed] [Google Scholar].

42. Vix M, Diana M, Marx L, Callari C, Wu HS, Perretta S, et al. Management of staple line leaks after sleeve gastrectomy in a consecutive series of 378 patients. Surg Laparosc Endosc Percutan Tech 2015;25(1):89-93.
43. Rossetti G, Fei L, Docimo L, Del Genio G, Micanti F, Belfiore A, et al. Is nasogastric decompression useful in prevention of leaks after laparoscopic sleeve gastrectomy? A randomized trial. J Invest Surg 2014; 27:234–239.
44. Mohammed Abbas, Abdelhafez Seleem Dilemma with leakage after sleeve gastrectomy. Al-Azhar Assiut Medical Journal, Vol. 16 No. 4, October-December 2018.
45. Halil Ozguc, Mustafa Narmanlı, Erdal Duman. Treatment of sleeve gastrectomy leak with an endoscopic stentUlusal Cer Derg 2014; 30: 169-72 DOI: 10.5152/UCD.2014.2661.
46. Puli SR, Spofford IS, Thompson CC. Use of self-expandable stents in the treatment of bariatric surgery leaks: a systematic review and metaanalysis. Clin Endosc 2012;75(2): 287-92.
47. Simon F, Siciliano I, Gillet A, Castel B, Coffin B, Msika S. Gastric leak after laparoscopic sleeve gastrectomy: early covered self-expandable stent reduces healing time. Obes Surg 2013; 23: 687-692. [CrossRef].
48. Dakwar A, Assalia A, Khamaysi I, Kluger Y, Mahajna A. Late complication of laparoscopic sleeve gastrectomy. Case Rep Gastrointest Med 2013; 2013:136153.
49. Fridman A, Szomstein S, Rosenthal RJ (2015) Postoperative bleeding in the bariatric surgery patient. 21: 241-247.
50. Shikora SA, Kim JJ, Tarnoff ME. Reinforcing gastric staple-lines with bovine pericardial strips may decrease the likelihood of gastric leak after laparoscopic roux-en-Y gastric bypass. Obes Surg. 2003;13(1):37–44.
51. Klaassen RA[1], Selles CA[1], van den Berg JW[1], Poelman MM[2], van der Harst E[1]Tranexamic acid therapy for postoperative bleeding after bariatric surgery. BMC Obes. 2018 Dec 3;5:36. doi: 10.1186/s40608-018-0213-5. eCollection 2018.
52. Parikh A, Alley JB, Peterson RM, Harnisch MC, Pfluke JM, Tapper DM, et al. Management options for symptomatic stenosis after laparoscopic vertical sleeve gastrectomy in the morbidly obese. Surg Endosc 2012; 26: 738–46. doi: https://doi.org/ 10.1007/s00464-011-1945-1.

53. Brethauer SA, Hammel JP, Schauer PR. Systematic review of sleeve gastrectomy as staging and primary bariatric procedure. Surg Obes Relat Dis 2009; 5: 469–75. doi: https://doi.org/10.1016/j.soard.2009.05.011.
54. Cottam D, Qureshi FG, Mattar SG, Sharma S, Holover S, Bonanomi G, et al. Laparoscopic sleeve gastrectomy as an initial weight-loss procedure for high-risk patients with morbid obesity. Surg Endosc 2006; 20: 859–63. doi: https://doi.org/10.1007/s00464-005-0134-5.
55. Burgos AM, Csendes A, Braghetto I. Gastric stenosis after laparoscopic sleeve gastrectomy in morbidly obese patients. Obes Surg 2013; 23: 1481–6. doi: https://doi.org/10.1007/s11695-013-0963-6.
56. Binda A, Jaworski P, Tarnowski W. Stenosis after sleeve gastrectomy – cause, diagnosis and management strategy. Pol Przegl Chir 2013; 85: 730–6. doi: https://doi.org/10.2478/pjs-2013-011215.
57. Parikh A, Alley JB, Peterson RM, Harnisch MC, Pfluke JM, Tapper DM, et al. Management options for symptomatic stenosis after laparoscopic vertical sleeve gastrectomy in the morbidly obese. Surg Endosc 2012; 26: 738–46. doi: https://doi.org/10.1007/s00464-011-1945-1.
58. Dapri G, Cadière GB, Himpens J. Laparoscopic seromyotomy for long stenosis after sleeve gastrectomy with or without duodenal switch. Obes Surg 2009; 19: 495–9. doi: https://doi.org/10.1007/s11695-009- 9803-0.
59. Rebibo L, Hakim S, Dhahri A, Yzet T, Delcenserie R, Regimbeau JM. Gastric stenosis after laparoscopic sleeve gastrectomy: diagnosis and management. Obes Surg 2016; 26: 995–1001. doi: https:// doi.org/10.1007/s11695-015-1883-4.
60. Chivot C, Robert B, Lafaye N, Fuks D, Dhahri A, Verhaeghe P, et al. Laparoscopic sleeve gastrectomy: imaging of normal anatomic features and postoperative gastrointestinal complications. Diagn Interv Imaging 2013; 94: 823–34. doi: https://doi.org/10.1016/j.diii.2013.03.017.
61. Iannelli A, Martini F, Schneck AS, Gugenheim J. Twisted gastric sleeve. Surgery 2015; 157: 163–5. doi: https://doi.org/10. 1016/j.surg.2014.01.018.
62. Uglioni B, Wölnerhanssen B, Peters T, Christoffel-Courtin C, Kern B, Peterli R. Midterm results of primary vs. secondary laparoscopic sleeve gastrectomy (LSG) as an isolated operation. Obes Surg 2009; 19: 401–6. doi: https://doi.org/10.1007/s11695- 009-9804-z.

63. Levine MS, Carucci LR. Imaging of bariatric surgery: normal anatomy and postoperative complications. Radiology 2014; 270: 327–41. doi: https://doi.org/10.1148/radiol.13122520.
64. Parikh A, Alley JB, Peterson RM, Harnisch MC, Pfluke JM, et al. (2012) Management options for symptomatic stenosis after laparoscopic vertical sleeve gastrectomy in the morbidly obese. Surg Endosc 26: 738-746.
65. Eubanks S, Edwards C, Fearing N, et al. Use of endoscopic stents to treat anastomotic complications after bariatric surgery. J Am Coll Surg. 2008;206:935–9.
66. de Moura DTH, Jirapinyo P, Aihara H, Thompson CC. Endoscopic tunneled stricturotomy in the treatment of stenosis after sleeve gastrectomy. VideoGIE. 2018 Nov 13;4(2):68-71. doi: 10.1016/j.vgie.2018.09.013. eCollection 2019 Feb.
67. Sudan R, Kasotakis G, Betof A, et al. Sleeve gastrectomy strictures: technique for robotic-assisted strictureplasty. Surg Obes Relat Dis. 2010;6:434–6.
68. Kalaiselvan R, Ammori BJ (2015) Laparoscopic median gastrectomy for stenosis following sleeve gastrectomy. Surg Obes Relat Dis 11: 474-477.
69. Klepac SR, Samett EJ. Spleen trauma. Available at: http://emedicine.medscape.com/article/373694-overview. Accessed May 21, 2009.
70. Gregorczyk M, Dabkowska A, Tarka S, et al. The anatomy of the fundic branches of the stomach: preliminary results. Folia Morphol 2008; 67; 2: 121-5.
71. Smyrniotis V, Kehagias D, Voros D, Fotopoulos A, Lambrou A, Kostopanagiotou G, Kostopanagiotou E, Papadimitriou J: Splenic abscess. An old disease with new interest. Dig Surg 2000;17:354–357.
72. Ertuğrul İ, Yaylak F, Şenkul M, Atlı E, Tardu A. Splenic infarction after laparoscopic sleeve gastrectomy. Laparosc Endosc Surg Sci 2018;25(1):67-69 DOI: 10.14744/less.2018.97759.
73. Arruabarrena A, Azagra JS, Wilmart JF, et al. Unusual complication after laparoscopic left nephrectomy for renal tumour: a case report. Videosurgery and other miniinvasive techniques 2010; 5: 60-4.
74. Katz SC, Pachter HL. Indications for Splenectomy. Am Surg 2006; 72: 565-80.
75. Habermalz B, Aauerland S, Decker G et al. Laparoscopic splenectomy: the clinical practice guidelines of the European Association for Endoscopic Surgery (EAES). Surg Endosc 2008; 22: 821-48.

76. Samama MM. An epidemiologic study of risk factors for deep vein thrombosis in medical outpatients: the Sirius study. Arch Intern Med. 2000;160(22):3415–20.PubMedCrossRefGoogle Scholar.
77. Hansson PO, Eriksson H, Welin L, et al. Smoking and abdominal obesity: risk factors for venous thromboembolism among middle-aged men: “the study of men born in 1913.”. Arch Intern Med. 1999;159(16):1886–90.PubMedCrossRefGoogle Scholar.
78. Dhanasopon, AP, Lewis, CE, Folek, JM, Dutson, EP, Mehran, A. Splenic infarct as complication of sleeve gastrectomy. Surg Obes Relat Dis. 2009;5:626–629.
79. Stamou, KM, Menenakos, E, Gomatos, IP. Clinical implications of sleeve gastrectomy as a source of spleen infarction or ischemia. Obes Surg. 2011;21:1490–1493.
80. Salinas, J, Barros, D, Salgado, N. Portomesenteric vein thrombosis after laparoscopic sleeve gastrectomy. Surg Endosc. 2014;28:1083–1089. Google Scholar .
81. Haglund, U, Norlen, K, Rasmussen, I. Complications related to pneumoperitoneum. In: Bailey, RW, Flowers, JL, eds. Complications of Laparoscopic Surgery. St. Louis, MO: Quality Medical Publishing Inc.; 1995:45–48.
82. Primignani M, Martinelli I, Bucciarelli P, et al. Risk factors for thrombophilia in extrahepatic portal vein obstruction. Hepatology. 2005;41:603– 608.
83. Muneer, M, Abdelrahman, H, El-Menyar, A. Portomesenteric vein thrombosis after laparoscopic sleeve gastrectomy: 3 case reports and a literature review. Am J Case Rep. 2016;17:241–247.
84. Condat B, Pessione F, Hillaire S, et al. Current outcome of portal vein thrombosis in adults: risk and benefit of anticoagulant therapy. Gastroenterology. 2001;120:490 – 497.
85. Kalabin A, Mani VR, Mishra A, Depaz H, Ahmed L. Acute pancreatitis with splenic infarction as early postoperative complication following laparoscopic sleeve gastrectomy. Case Rep Surg. 2017;2017:8398703. [PMC free article] [PubMed] [Google Scholar]
86. Sarwal A, Khullar R, Sharma A, Soni V, Baijal M. Acute pancreatitis as an unusual early post-
operative complication following laparoscopic sleeve gastrectomy. J Minim Access Surg. 2018 Apr-Jun;14(2):164-167. doi: 10.4103/jmas.JMAS_169_17.
87. Ranson JHC. Acute pancreatitis. In: Zinner MJ (ed). Maingot’s Abdominal Operations. 10th ed. Appleton & Lange, 1997:1899- 915.

88. O. Le Moine, C. Matos, J. Closset, and J. Deviere, "Endoscopic ` management of pancreatic fistula after pancreatic and other abdominal surgery," Best Practice and Research: Clinical Gastroenterology, vol. 18, no. 5, pp. 957–975, 2004.
89. Özbalcı GS, Polat AK, Tarım İA, Derebey M, Nural MS, Tümentemur V, Karabacak U. A Pancreatic Fistula after the Laparoscopic Sleeve Gastrectomy. Case Rep Surg. 2015;2015:910583. doi: 10.1155/2015/910583. Epub 2015 May 11.
90. E. Lermite, D. Sommacale, T. Piardi et al., "Complications after pancreatic resection: diagnosis, prevention and management," Clinics and Research inHepatology and Gastroenterology, vol. 37, no. 3, pp. 230–239, 2013.