Computerized Axial Tomography Role in Detection of Complications of Laparoscopic Sleeve Gastrectomy

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ABSTRACT

Background: Obesity is associated with a variety of chronic illnesses such as diabetes mellitus (DM), cardiovascular disease (CVD), steatotic liver disease, and cancer. Bariatric surgery, most frequently Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG), is an efficient therapeutic option for obesity and could help with accompanying co-morbidities. The number of bariatric approaches has increased over the last 20 years in response to the growing obesity epidemic. SG is the most often done bariatric surgery today, and while it serves as a long-term choice for certain cases, it is crucial to remember that various complications may develop.

Objective: Studying of the computerized axial tomography role in detection of complications of LSG.

Methods: Using the following keywords [Obesity, Laparoscopic Sleeve Gastrectomy, Computerized Axial Tomography and Sleeve gastrectomy gastric leak] were all searched through Science Direct, Google Scholar, and PubMed. The writers also reviewed relevant literature references, although they only included the most recent or comprehensive study. Documents in languages other than English have been excluded due to a lack of translation sources. Unpublished papers, oral presentations, conference abstracts, dissertations, and other works that were outside the scope of large-scale scientific studies were excluded.

Conclusion: CT is very important in the diagnosis of early complications after LSG. Recognizing the most common and feared adverse events of LSG, which include sleeve stenosis and gastric leakage, requires radiological examination. Throughout the world, LSG is quickly rising to the top of the bariatric procedure list. A growing number of post-LSG evaluations will be required of radiologists due to the anticipated massive increase in surgical volume.

Keywords: Obesity, Laparoscopic Sleeve Gastrectomy, Computerized Axial Tomography, Sleeve gastrectomy gastric leak.

INTRODUCTION

Worldwide, LSG is the most common type of bariatric surgery. Its popularity stems from its ease of use and greater weight loss outcomes in comparison with more invasive bariatric procedures that call for gastrointestinal anastomoses [1-2]. The most feared consequence following a sleeve gastrectomy is gastric leak,

although being rare, because of its morbidity and the requirement for an extended hospital stay, intensive resource utilization, and multidisciplinary team care [4-6].

When evaluating postsurgical complications in clinically suspected symptomatic cases, imaging is a crucial diagnostic tool. Its routine application in the early postsurgical phase is debatable, albeit [5]. Early gastric leak detection appears to have no usefulness, according to several studies examining regular postsurgical upper gastrointestinal (UGI) contrast scans carried out before to patient release [6-7].

Because gastric leak often happens 1-2 weeks after a sleeve gastrectomy, routine early computed tomography (CT) utilizing an oral contrast agent performed on postsurgical day 2 also has a limited role in the diagnosis of asymptomatic gastric leaking [8]. A typical postsurgical CT scan displays the transaction site and the remaining stomach sleeve with a staple line. There isn't a collection along the staple line, a gas leak, or a contrast leak [8].

The timely identification of stomach leaks is essential as it facilitates prompt therapy, lowers morbidity, and enhances patient outcomes [8]. To diagnose stomach leaks, the most sensitive approach is to have a high clinical index of suspicion [9]. Clinical manifestations can range widely, from septic shock to asymptomatic [10]. The most typical clinical indications, however, are tachycardia, fever, and left shoulder or stomach pain [11].

The most effective diagnostic technique for stomach leaks, accompanying problems, and other differential diagnoses is abdominal CT with IV and oral contrast in patients with suspected leakage [12]. Of note, the majority of reported studies that describe the CT outcomes of gastric leaking following a sleeve gastrectomy are reviews. There are a few original publications, however because of the uncommon incidence, which ranges from 1% to 3%, these have limited patient numbers. The literature has reported gas leak, staple line defects, perigastric collection, contrast leak, and gas leak as CT findings indicative of gastric leaking [5, 13].

For patients with symptoms suggesting a gastric leak, UGI contrast fluoroscopy studies and CT scans are the most often utilized imaging tests. It is thought that plain radiography has minimal utility in identifying gastric leaks following sleeve gastrectomy [3]. Though studies using UGI contrast fluoroscopy have a significant false-negative rate, CT is still the gold standard diagnostic technique. While CT is the best approach, some facilities may not have access to it, and

because of limited CT gantry capacity, superobese patients cannot be accommodated [14].

Operative Technique:

The patient's arms are stretched wide apart while they lie supine. Using a closed approach, pneumoperitoneum is achieved by inserting a Veress needle into the left subcostal region of the abdomen. The left midabdominal and supraumbilical regions each had two 10 mm ports inserted. To pass the stapler, a second 15 mm port is inserted into the right mid-abdomen. Lastly, the upper quadrants of the left and right abdomens receive two more 5 mm openings. Using a Nathanson retractor inserted into the subxiphoid region, the left hepatic lobe is retracted medially [15].

An orogastric tube is introduced to cause gastric decompression at the start of the procedure. The first assistant is positioned to the patient's left, while the surgeon is to the patient's right. The left cru of the diaphragm is exposed when the angle of His is bluntly reduced with the Goldfinger dissector. The Harmonic Scalpel is used to cut the gastrocolic ligament, which initiates dissection approximately six cm proximal to the pylorus. Proximally, in the direction of the short stomach arteries, dissection is performed. As a result, attachments to the gastric fundus and the stomach's larger curvature are released. The anesthesiologist then removes the orogastric tube and replaces it with a 50-French bougie, which is guided laparoscopically to sit in the stomach's lesser curvature immediately distal to the pylorus. A 60 mm Endo GIA tri-stapler is then used to separate the stomach. We begin by dividing the distal stomach with two black cartridges, 6 cm proximal to the pylorus. Next, 4-6 60 mm purple cartridges are used to divide the remaining stomach. The specimen is subsequently removed from the abdominal cavity using the 15 mm port. After removing the bougie, an intraoperative gastroscopy is carried out using methylene blue and air insufflation to rule out any leaks. Before exsufflation of the abdomen, we routinely shut our 15 mm port fascia under direct eye. Following surgery, patients are given nothing by mouth. In order to rule out staple line leaking, an UGI investigation using gastrografin is performed on the first postoperative day. After that, a clear fluids diet is started [15].

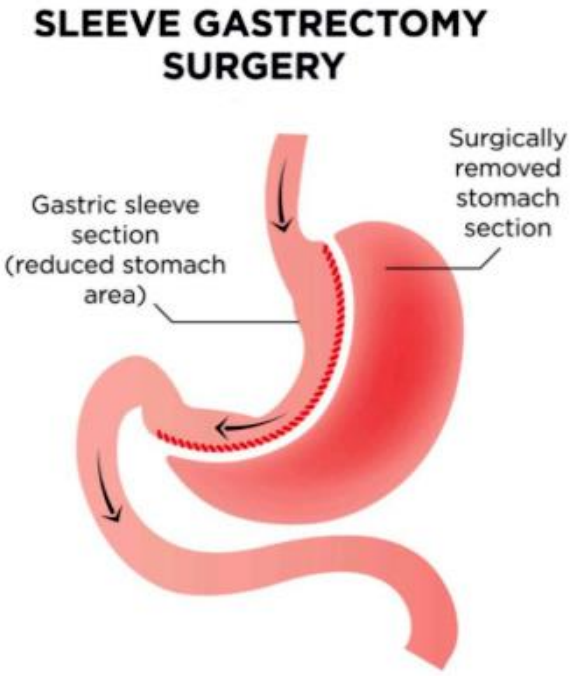

Figure (1): Sleeve gastrectomy.

Laparoscopic Sleeve Gastrectomy (LSG):

Due to its great efficacy for weight loss in the short-term follow-up, the LSG has recently gained popularity as a single-stage operation for the treatment of morbid obesity and its comorbidities **[16].** LSG is described as one of the bariatric surgeries called restrictive operation, it affects body through making a sensation of early satiety for these persons. In addition to lowering level of ghrelin hormone, which secretes from gastric fundus, and this gastric fundus is resected at LSG operation **[17].**

Reducing the stomach volume, that affecting and decreases food and diet intake, and it becomes the chief and basic fact described how LSG acts. So, the RGV is important to reach a good result to reach the needed weight loss. Many factors during and after surgeries may affects the RGV such as, size of bougie used in the surgery, the site between 1st section and pylorus of the stomach, the site in between the bougie and operation suture line, or reinforcement material and substances used in the gastric section **[18].**

Radiological Evaluation of Complications of LSG:

Following a liver transplant, the imaging assessment of patients mainly uses CT scans, fluoroscopy, UGI series, and plain radiography, to a lesser degree. Because some members of the bariatric population may exceed the weight and size restrictions of their equipment, radiologists should be aware of these restrictions. While its routine usage in the postoperative period is debatable,

imaging is crucial for evaluating postoperative failure and identifying postsurgical problems [19].

Conventional UGI tract fluoroscopy is employed less frequently in cases of weight loss failure or weight regain, and is utilized for the examination of gastric leakage and stenosis. An abdominal CT scan could reveal leaks and stenosis as well as provide further information on extragastric abnormalities and problems, such as the existence of an incisional hernia, intra-abdominal hematoma, and abscess [19].

Complications of SG:

The prevalence of adverse events after sleeve gastric resection according to the studies is to somewhat low. Historically, LSG has been considered as a technically straightforward bariatric approach, with favourable outcomes with regard to weight loss, reduction of comorbidities, and postsurgical complications. LSG is less invasive and dangerous than other weight loss surgeries like gastric bypass and biliopancreatic diversion [20].

Abdominal CAT ideally completed by using oral and intravenous contrast agents. We aimed CT study was to know and recognize the normal anatomy after LSG and detecting any postsurgical complications after this operation. The radiological findings favor fistula is described as follows: escaping or passage of oral contrast material through the wall of the gastric sleeve, contrast and fluid collection nearby to the sleeve, presence of free fluid within abdomen, presence of liquid air within abdomen and detection of oral contrast material within the drainage tube situated after surgery [21].

Acute Complications:

Fistulas and Pleural Effusion

Most surgical procedures tend to mix up the terms fistula and leaking. Fistulas are abnormal openings that allow secretions and fluids to move from one organ to another. The causes of fistula are easy to deduce. Subphrenic infectious sequelae commonly result in gastrocutaneous fistula, lung infection, and pleural effusion because of a staple line leak. However, several reports of individuals developing a gastro-bronchial fistula following bariatric procedures have been documented. The most life-threatening consequences include gastric-to-cutaneous and gastric-to-bronchial fistulas [22].

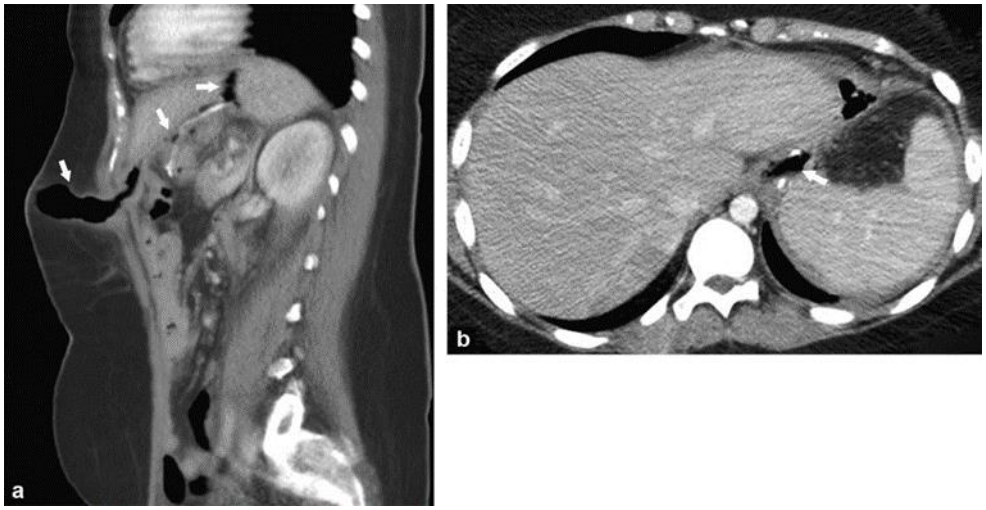

Figure (1): Gastro-cutaneous fistula. a: Gas bubbles (white arrow) can be seen extending from the gastro-cutaneous fistula in the upper part of the staple line on a sagittal CT of the abdomen taken following laparoscopic surgery for the gastrointestinal tract. b: This fistula was caused by a significant leak at the top of the staple line, as shown on axial CT [22].

Hemorrhage

Hemorrhage during and after LSG may be problematic, as it may end into reoperation, abscess formation, blood transfusion and stay prolonged time at hospital. The LSG involves the longest gastric staple line of any procedure and is closest to the vascular supply of the lesser curvature, and may therefore be abler to bleed intra-operatively and postoperatively [23].

Splenic infarction and splenic abscess formation

The division of the short gastric vasculature after laparoscopic Nissen fundoplication has been linked to splenic infarction and splenic abscess development. LSG needs gastric fundus good mobilization and perfect division of short gastric vasculature. Hence, upper splenic pole ischemia and necrosis may be observed. Old reports have reported and documented splenic infarcts in the early postoperative course. Some cases may be much more complicated with development of splenic abscesses [24].

Stricture

Gastric stricture is considered as one of documented postsurgical complications after bariatric surgeries mainly LSG (gastric conduit stricture), after LSG the remnant part of stomach becomes a narrow cylindrical and tubular structure, that is susceptible for stenosis and obstruction. On the in contrast to leaks, strictures rarely noticed or mentioned in clinical series [25].

Vascular Thrombo-embolism

The bariatric individuals are at superior risk for development of deep venous thrombosis (DVT) and they have a slight cardiopulmonary reserve if a pulmonary embolus occurs. The prevalence of symptomatic pulmonary emboli after bariatric surgery as LSG is generally reported as 1%–2%, while a lot of patients are not diagnosed and the real incidence in these patients is probably much higher. Pulmonary embolism represents about 0.3% of complications after LSG [26].

Intra-abdominal abscess formation

One of the possible complications following LSG is intra-abdominal abscess. It typically appears with manifestations which include diffuse abdominal pain and discomfort, nausea and vomiting or fever/chills. If there are any doubt suspected clinically, doctors advised patient to do further assessment with contrast enhanced spiral CT to exclude presence of any intraabdominal abscess [27]. In a group of 164 cases following LSG, Lalor et al. [28] recorded one person with intra-abdominal abscess (0.7%). Treating of this complication achieved by drainage percutaneously and covering antibiotics.

Wound

Although the risk of wound problems is reduced with laparoscopy, it is still possible for difficulties to arise. Small gas or fluid collections deep within the closed trocar incision and adjacent tissues can be seen on CT, aiding in early diagnosis of wound infection, which is typically confirmed clinically. The clinical diagnosis of a strangulated hernia through the trocar orifice is another type of wound complication. A hard, tiny defect in the abdominal wall allows a part of the anti-mesenteric wall of the intestine to protrude, and/or strangulate, through the defect; this is known as a Richter's hernia [29].

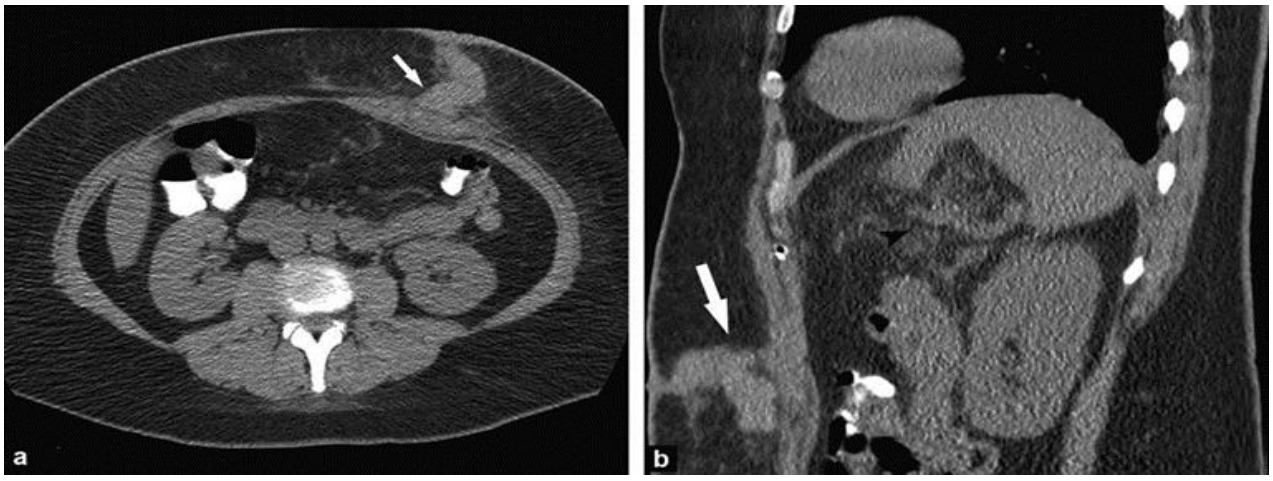

Figure (2): Trocar incision site hematoma of the abdominal wall. A: A high-attenuation subcutaneous accumulation was observed over the trocar incision on an axial CT scan of the upper abdomen (white arrow). B: Upper abdominal subcutaneous hematoma as seen on sagittal CT (white arrow) [29].

Chronic Complications:

Nutritional deficiencies

Nutritional deficits following bariatric surgery aren't uncommon. Due to decreased oral intake and poor absorption, the cause is complex. The prevalence of cobalamin, vitamin D, folate, iron, and zinc deficiency was recorded to be 3%, 23%, 3%, 3%, and 14%, respectively, following LSG in a recent study by Gehrer and colleagues [30]. Micronutrient deficits were generally less common following LSG than following RYGB; on the other hand, folate deficiency was marginally more common following LSG than following RYGB (22% vs. 12%). Therefore, routine blood tests to diagnose vitamin and mineral shortages following LSG is necessary. At three, six, and twelve months following surgery, patients' serum levels of cobalamin, vitamin D, folate, iron, and calcium should be regularly monitored, and they should get appropriate treatment if needed [30].

Gastroesophageal reflux disease (GERD)

It is a predominant problem among patients undergoing bariatric surgery. While some surgeries, which include the RYGB, are known to be linked to a lower incidence of reflux after surgery, this is debatable with LSG. Chiu et al. carried out a recent systematic study [31] and found no solid evidence regarding the impact of LSG on GERD. Out of the included trials, four demonstrated a postoperatively increased incidence of GERD, while seven demonstrated a decreased incidence. In a retrospective analysis of cases who had LSG, Carter and colleagues [32] discovered that 47% of their patients continued to experience GERD symptoms after more than 30 days. The two most often mentioned symptoms were regurgitation (29%) and heartburn (46%) in the reports. Proton pump inhibitors (PPIs) are used in the management of patients with persistent GERD. These patients need to be closely monitored clinically. Proton pump inhibitors are normally used to treat symptoms, but if they don't go away, a gastroscopy is typically ordered.

Other Complications:

There have been records of further SG complications. 0.1% of cases have splenic damage, which is uncommon and most likely results from surgical dissection of

the left upper quadrant [22]. The most common splenic damage following LSG is infarction, which typically happens near the superior splenic pole. When doing LSG, it may arise from the intraoperative closure of the short gastric arteries in order to move the gastric fundus. A well-defined wedge-shaped peripheral nonperfused hypodensity is visible on a contrast-enhanced CT scan [22].

CONCLUSIONS

CT is very important in the diagnosis of early complications after LSG. Radiological examination is critical in identifying the most common and feared complications of LSG, including gastric leakage and sleeve stenosis.

LSG has quickly become a common bariatric surgery all over the world. Given the anticipated massive rise in surgery volume, radiologists will be faced with an increasing number of post-LSG tests.

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