Radiological assessment of Gastric Sleeve Complication By Multislice CT study

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Abstract

Background: Currently, laparoscopic sleeve gastrectomy (LSG) has emerged as the most widely used bariatric treatment in contemporary practice. The use of computed tomography (CT) during the first post-operative phase is essential in the event of early postsurgical complications.

Objectives: The purpose of the research was to know the value of CT in the evaluation of the complications of LSG.

Patients and methods: This observational cohort research included a sample of hundred and fifty-five individuals who had LSG. CT scans were performed on all participants who were either radiologically or clinically suspected of experiencing complications.

Results: A total of hundred fifty-five individuals were included in the screening process for this research. Among them, a hundred of the participants (64.5%) exhibited normal conditions, with no indications of complications. Out of the total sample size of fifty- five patients, a significant proportion of 35.5% were found to have variable outcomes. The most prevalent complication observed in the present research was leakage, occurring in twenty instances (11%). Among these cases, five were recognized within forty-eight hours after surgery, while the other fifteen cases were identified between seven- and five-days post-surgery. Pneumonia was diagnosed in five cases, representing 2.75% of the total sample. The prevalence of fistula was found to be five cases, accounting for 2.75% of the total sample. Stenosis was seen in four cases, representing 2.2% of the sample. The occurrence of abscess collection was noted in six cases, constituting 3.3% of the sample. A single case of pulmonary embolism was identified, accounting for 0.55% of the sample. A total of six instances (3.3%) were found to have hematoma based on CT scans, while two cases (1.1%) were identified as having splenic abscess using CT imaging. Portal venous thrombosis occurred in one out of hundred eighty-two instances, resulting in a prevalence rate of 0.55%. Additionally, dilatation of the gastric sleeve pouch was seen in five out of hundred eighty-two cases, corresponding to a prevalence rate of 2.75%.

Conclusion: Given the growing frequency and prevalence of LSG, CT is a crucial imaging modality used for the identification of potential problems with accurate diagnoses and achieving precision. Additionally, CT is employed in situations when there is a discrepancy between and the results obtained from regular upper gastrointestinal tract (GIT) tests and symptoms reported by the patient

Keywords: LSG; complications; CT.

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Introduction

Obesity has been recognized as a major medical issue for the worldwide population. According to projections, the global prevalence of overweight individuals is anticipated to reach a maximum of 38.1%, while the prevalence of obesity is expected to reach 19.7% by the year 2030 (**Cylke et al., 2021)**

Obesity is a multifaceted issue with medical and social implications, often seen as a comorbidity associated with several diseases such as type 2 diabetes mellitus, hypertension, and some forms of cancer. The frequency of its manifestation is persistently escalating at a concerning pace.**(Latif et al., 2020)**

The body mass index (BMI) serves as a metric for assessing obesity, derived from the ratio of an individual's weight to their height squared (BMI = weight in kilograms/height in meters^2). The classification of weight status is based on BMI, with overweight being defined as a BMI ranging from twenty-five to twenty-nine kg/m2, obesity as a BMI ranging from between thirty and thirty-five kg/m2, and severe obesity as a BMI above thirty-five to Forty kg/m2. **(Levine and Garucci, 2014)**

Bariatric surgery is widely recognized as the most intrusive therapeutic intervention for obesity, therefore making it most suitable for those who have not achieved weight loss using conventional methods such as behavioral modifications, dietary adjustments, and physical activity. Notwithstanding these recommendations, there has been a significant spike in the use of bariatric surgery. **(Levine and Garucci, 2014)**

According to the American Society for Metabolic, Bariatric Surgery (ASMBS) and the International Federation for the Surgery of Obesity (IFSO), Currently, laparoscopic sleeve gastrectomy (LSG) has emerged as the prevailing bariatric operation in these days **(Deręgowska-CylkeM and Palczewski, 2021)**

Imaging assumes a significant role in the treatment and assessment of patients after surgical procedures. Having a comprehensive understanding of the anatomical changes that occur after surgery enables correct analysis of imaging results pertaining to both typical post-surgical outcomes and often encountered problems. **Chandler et al., 2008)**

As a result, gastroscopy after bariatric surgery is typically challenging. If early complications occur in the early postoperative period, radiographic imaging is required **Lemanowicz , 2014)**.

The purpose of the research was to know the value of CT in the evaluation of the complications of LSG

Patients and methods:

Study design

The present investigation was conducted in the form of an observational prospective cohort research. All patients who had LSG got the regular clinical care that is typically provided in such cases. The objective of our study was to assess the efficacy of multislice CT in the diagnosis and assessment of problems arising after LSG in patients who presented with either clinical symptoms or radiological indications of potential complications. The researchers got written informed permission from each patient and gained clearance from the medical ethics committee.

Patients

A total of hundred fifty-five patients (fifty-five men and Hundred females) who had LSG were included in this research, spanning from January 2022 to August 2023. The age range of the participants was from ten to fifty years old. Among these patients, one hundred experienced no complications, whereas fifty-five individuals (ten males

and forty-five females) suffered from postoperative complications.

*Inclusion criteria: All patients who had LSG throughout the research period who exhibited radiologically or clinically suspected problems, including in cases where the Upper GI series yielded negative findings.
*exclusion criteria: was anyone diagnosed with renal insufficiency, individuals with documented pregnant women and contrast hypersensitivity. Contrast-enhanced computed tomography (CE-CT) was performed on all patients.

A CT scan was performed using the Phillips Incisive CT system. CT without the use of enhancement agents is conducted in order to identify the presence of bleeding. Subsequently, a sequence is carried out following the ingestion of contrast material orally to identify any leakage or fistula. Finally, a contrast-enhanced CT is done. CT was conducted using a one hundred ml volume of omnipaque, a contrast agent containing three hundred mg of Iodine per milliliter (Iohexol, GE health care Ireland, Cork, Ireland). The contrast agent was administered by an 18-gauge cannula inserted in the anticubital fossa, at a rate of 5 ml/s, followed by the injection of thirty ml of normal saline. An automatic injector was used, with a forty-second delay before the injection. The postoperative CT scan reveals the presence of a sleeve, characterized by a clearly discernible staple line in close proximity to the stomach. Importantly, no evidence of contrast material leakage or abscess formation in direct contact with the staple line is seen. In CT exams, a scout image is acquired by an anterior-posterior (AP) scan projection radiograph. The parameters used for the imaging procedure were as follows: the slice thickness was set to five mm, the reconstruction interval was set to one mm, and the field of view was set to thirty-five cm. The kilovolt (kV) range used was between hundred twenty and hundred forty, while the milliampere-second (mAs) value was set to two hundred. The outcome of bariatric surgery of studied hundred fifty five patients are as follows: hundred patients (64.5%) were radiologically and clinically free, and fifty five patients (35.5%) showed different complications.

Clinically suspected complications were hypotension, sudden tachycardia severe persistent abdominal pain and abdominal distension

Statistical analysis

The statistical expressions used to characterize the data were mean, range, frequency (number of instances), and percentage.

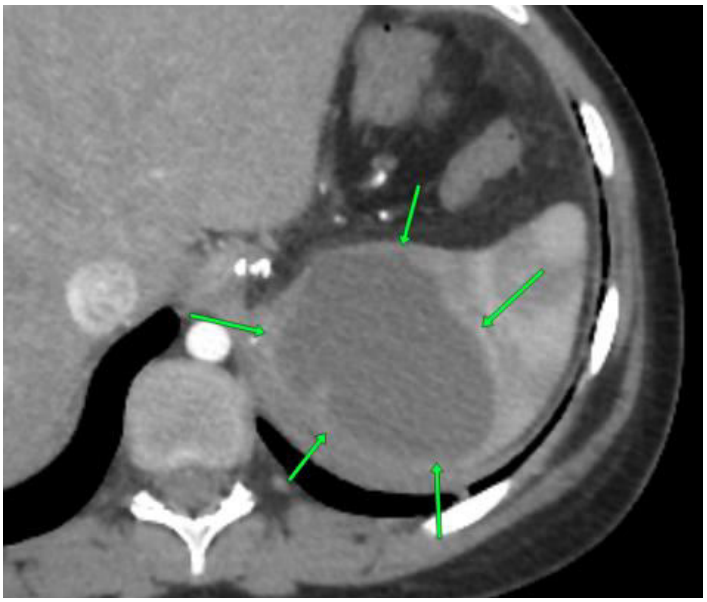
Results

We screened eighty-five patients in this research, thirty patients (25.5%) were normal, no evidence of complication. Fifty-five patients (46.75%) suffer from variant findings. The most common consequence, as mentioned in (**Table.1**), was leakage, occurring in twenty cases (11%). Of these, five cases were recognized within forty-eight hours after surgery, while the other fifteen were identified within five to seven days post-surgery. Pneumonia was diagnosed in five cases, accounting for 2.75% of the total cases. Fistula five (2.75%), stenosis four (2.2), abscess collection six (3.3%), and pulmonary embolism one (0.55%). Hematoma was detected by CT in six cases (3.3%), Splenic abscess was detected by CT in two (1.1%) cases and appeared as well-defined hypodense collection triangular-shaped area in the upper pole , Portal vein thrombosis one (0.55%) &dilatation of the gastric sleeve pouch in five cases (2.75%)

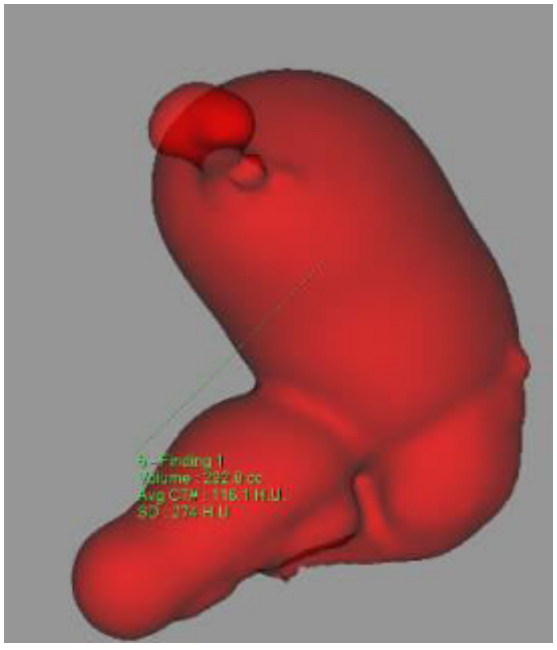
Table 1. Number and percent of LGS post operative complications

Complications	Number	Percent
Leak	20	11%
Within 48 hr	5	25
Within 5-7 days	15	57
Pneumonia	5	2.75
Fistula	5	2.75
Stenosis	4	2.2
Abscess	6	3.3
Pulmonary embolism	1	0.55
Hematoma	6	3.3
Splenic abscess	2	1.1
Portal vein thrombosis	1	0.55
Dilatation	5	2.75

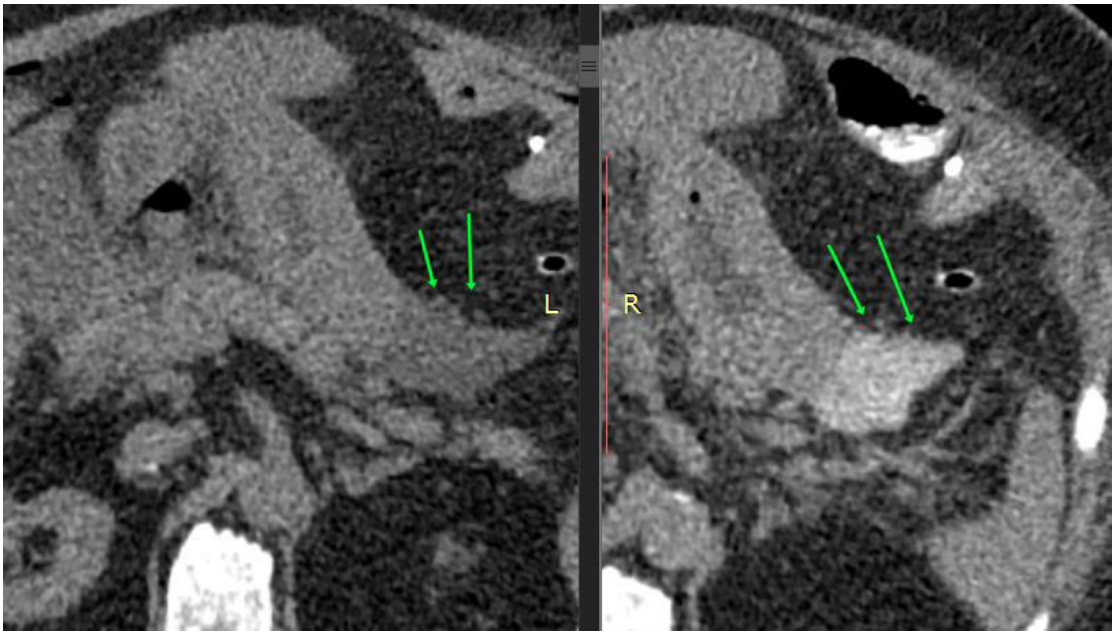
Case 1:
Male patient aged 10 years old underwent sleeve gastrectomy and presented with large collection is of upper one of the spleen (arrows) showing marginal enhancement suggesting abscess formation.



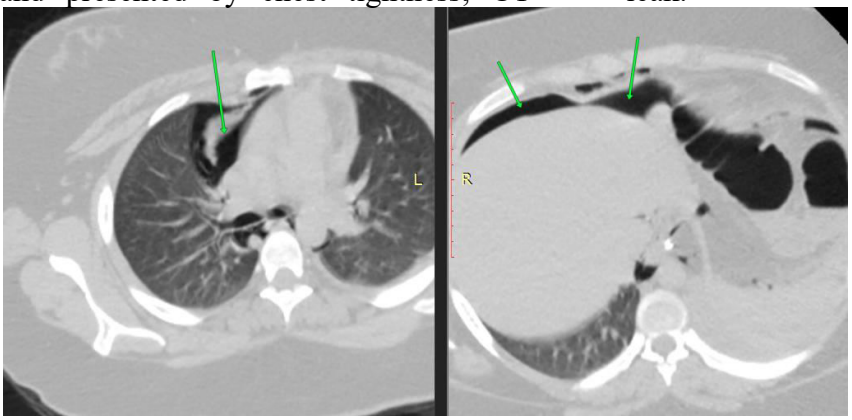
Case 2:
Female patient aged 42 years old sleeve gastrectomy 2 years ago and presented with recent gain of weight; CT gastric volumetry showed increased capacity of the stomach with a small hiatus hernia.

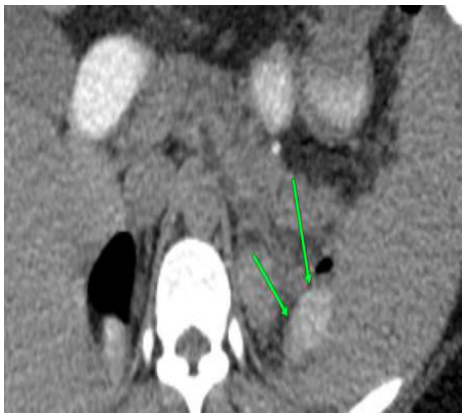


Case 3: Female patient aged 42 years old underwent sleeve gastrectomy and presented 2 days after my abdominal discomfort; CT showed active contrast leakage posterior to the stomach (arrows).

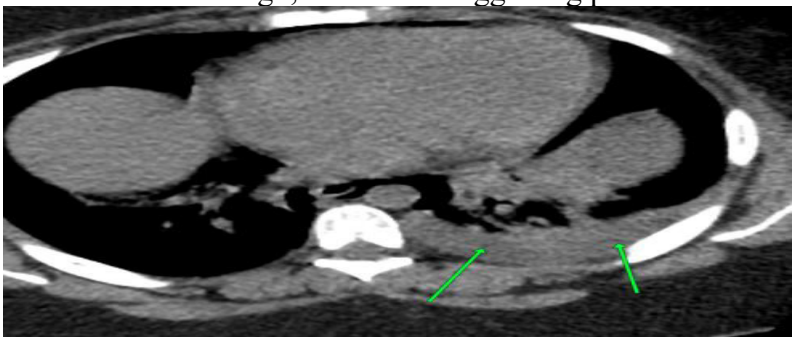


Case 4: Female patient aged 24th years old underwent sleeve gastrectomy and presented by chest tightness; CT showed mild pneumomediastinum and pneumoperitoneum with active contrast leak.





Case 5: Female patient aged 25 years old underwent sleeve gastrectomy and presented with fever and cough; CT showed left basal pulmonary consolidation and pleural effusion suggesting pneumonia.



Discussion

The LSG surgical procedure is considered to be a relatively recent development in the field.(**Gumbs et al., 2007)**. It constituted around 5% of the total bariatric surgical procedures performed in the year 2008 (**Buchwald et al., 2009)**

The procedure involves the creation of a long and slender gastric pouch with the removal of around 75% of the stomach. This treatment facilitates weight reduction by capitalizing on the restrictive impact exerted by the pouch.(**Shah et al., 2011)**

This research had a total of hundred fifty-five individuals, all of whom underwent CT scans. Out of these patients, hundreds were found to have normal findings, while problems were identified in fifty-five cases. It is worth noting that no instances of fatality were seen, which aligns with the findings reported by Chivot et al. (**Chivot et al .,2013)**who stated that the overall published complications rate ranges from zero% to twenty-four%.

Leakage emerged as the most prevalent consequence, manifesting in Twenty cases. Specifically, it was detected in the upper portion of the sleeve in fifteen people and in the bottom section in five cases, matching with previous findings**.(Deitel et al., 2012 ; Hassan et al., 2015)**) who stated that postoperative leak was observed in the upper part of the sleeve more than in the lower part in at their study group cases. The causes of leakage have been categorized. The period of observation for the patients was found to be within forty-eight hours in seven individuals, while in thirteen individuals it was observed from five to seven days after the surgical procedure.

Chivot et al.(2013) the occurrence of leaks during the first forty-eight hours might be attributed to mechanical or technical problems, but late-onset leaks (occurring within five to seven days) are mostly caused by ischemia resulting from strain and inadequate wound healing. In both situations, the intraluminal pressure surpasses the strength of the tissues and staple lines, leading to leakage. A comparison was made between the occurrence of a leak along the staple line and in the subphrenic area, which aligns with the explanation provided by experts regarding the preferred location for such leaks. (**Hassan et al., 2015; Kim et al., 2002)** A comparison was made between the occurrence of a leak along the staple line and in the subphrenic area, which aligns with the explanation provided by experts regarding the preferred location for such leaks. This preference is attributed to the movement of the greater curvature of the stomach following the transaction of the gastrosplenic ligaments and gastrocolic, resulting in the establishment of a connection between the left subphrenic space and lesser sac.

Nedelcu et al. (2013) created a CT classification of leak after LSG based on the location and size of fluid collections:

There are three kinds of abdominal collections:

1. Type one: This type refers to collections that are less than 5 cm and located in the left upper quadrant of the abdomen.
2. Type two: This type includes collections larger than 5 cm in the left upper quadrant of the abdomen. It further has two subtypes: a) negative leak visualization, and b) positive leak visualization.
3. Type three: This type involves widespread abdominal collections.
4. Type four: pleural collections refer to the presence of leaks in the thoracic region, specifically in connection to the gastric sleeve. The modifiers are used to highlight the precise location of the leak. In this classification system, the letters S, M, and I represent the categories of

superior, medium, and inferior, respectively.

The occurrence of infection is a potential early consequence after LSG. Abscess formation often arises as a consequence of a leakage, mostly found in close proximity to the staple line inside the left upper quadrant, with a higher incidence observed in the subphrenic region**.(Cylke et al., 2021)**

In the present research, abscess occurred in left subphrenic space in agreement with **(Hassan et al., 2015)** who reported similar incidence.

Postoperative hemorrhage often manifests at the site of the gastric staple line, predominantly during the first 72-hour postoperative period. This bleeding might manifest either inside the lumen of the GITor outside of it. (**Sarkhosh et al., 2013**)A total of six cases (3.3%) were identified to have hematoma by the use of CT, which matches the findings reported by Levine M. S. and Garucci M. R **(Levine et al., 2014).**

Two cases (6.7%) were identified with splenic infarction with the use of CT imaging. The infarctions were seen as clearly defined; non-enhanced, hypodense triangular areas located peripherally in the upper pole of the spleen. These infarctions were recognized ten days after the surgical procedure, aligning with the findings reported by Hassan T et al. (**Hassan et al., 2015**)) Who else has reported similar incidents A diverse array of anatomical variations exists in relation to the vascular supply of the spleen. Frequently, there are anastomotic connections between the vascular networks supplying the spleen and stomach. (**Stamou et al.,2011].** In the context of the LSG technique, it is essential to mobilize the gastric fundus and simultaneously ligate the short gastric capillaries. However, this maneuver has the potential to result in inadequate perfusion of the spleen, particularly affecting the top pole of the organ. Furthermore, it has been demonstrated that this condition has the potential to result in the development of splenic abscesses. (**Nassour et al., 2018**) as it appear in patient in present study

A single case (0.55%) of portal vein thrombosis was identified by CT during a period of four weeks after the surgical procedure. The delayed development of these problems may be attributable to the postoperative dietary quality that the patient was maintained on, which might potentially contribute to an elevated hypercoagulable condition (**Hassan et al., 2015**).

Gastric sleeve dilatation is a delayed issue that often manifests within two to three years post-surgery, as shown by a recent research including five individuals who received a CT examination after three years owing to weight regain.

The expansion of gastric remnants exhibits a gradual inclination, potentially resulting in weight recovery and serving as a motivating factor for the implementation of revisional bariatric surgery **(Cylke et al., 2021)** . The presence of a broad sleeve creation after an initial surgical procedure might be considered a predisposing factor for further dilatation. Additional variables that may contribute to the issue include the generation of excessive pressure resulting from the consumption of large quantities of food, frequent episodes of vomiting, or the presence of a stricture in the distal portion of the stomach residual.(**Ganger et al .,2003**)

We concur with the findings of Cylke et al., Chivot et al., and Hassan T et al. (**Cylke et al., 2021**, **Chivot et al., 2013**, **Hassan et al., 2015**)) who have shown that in cases where there is a significant clinical suspicion of difficulties, it is imperative to do a CT scan, even if postoperative upper gastrointestinal (UGI) imaging seem normal. This is

necessary to identify potential related complications such as abscesses and fistulas. CT may also provide additional significant information via the visualization of pneumoperitoneum or the presence of oral contrast material beyond the gastrointestinal lumen.

Conclusion

Given the growing frequency and prevalence of LSG, it is essential for radiologists to possess acknowledge and the ability to identify the potential problems associated with this intervention of surgical. CT is a crucial imaging modality used for the identification of potential problems arising from medical procedures, with the aim of accurate diagnoses and achieving precision. Additionally, CT is employed in situations when there is a discrepancy between and the results obtained from regular upper GIT tests and symptoms reported by the patient

List of Abbreviations:

LSG----------Laparoscopic sleeve gastrectomy
CT----------Computed tomography
BMI----------body mass index
IFSO----------International Federation for the Surgery of Obesity
ASMBS----------American Society for Metabolic and Bariatric Surgery
CE-CT----------contrast-enhanced computed tomography

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