Leakage Management after Laparoscopic Sleeve Gastrectomy: A Tertiary Center Experience in Saudi Arabia

Khalid M. Alzahrani (1)
Tamer M. Abdelrahman (1,2)
Sumayyah A. Jafri (3)
Mohammed Abdo (4)
Khalid A. Alsharif (4)

(1) Surgery Department, College of Medicine, Taif University, Taif, Saudi Arabia
(2) Surgery Department, Benha Teaching Hospital, General Organization of Teaching Hospital and Institutes, Egypt
(3) Department of Surgery, Al Hada Armed Forces Hospital, Taif, Saudi Arabia
(4) Department of Surgery, King Abdul Aziz Specialist Hospital (KAASH), Taif, Saudi Arabia

Corresponding author:
Khalid M. Alzahrani
ORCID: https://orcid.org/0000-0001-8231-4545
Assistant Professor, Department of Surgery, College of Medicine, Taif University
Alseteen Street, Alhaweyia, Al-Taif 21944, Saudi Arabia
Tel: + (966) 27242295 (2476); FAX: + (966) 27250528
Email: dr.k.al_zahrani@tu.edu.sa

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Abstract

Purpose: The goal of this study was to determine the optimal method for treating gastric leaks in terms of resolution rate, complications, admission to the intensive care unit (ICU), conversion to other surgical techniques, and mortality.

Methods: A retrospective analysis of patients treated at King Abdul-Aziz Specialist Hospital between 2017 and 2021 for post-LSG leaks. Age, gender, body mass index (BMI), preoperative comorbidities, leak rate, the interval between surgery and leak, the onset and site of leak, as well as the management lines and outcomes, were collected.

Results: The leak rate following Laparoscopic Sleeve Gastrectomy (LSG) at our hospital was 0.53 percent, and there were no statistically significant differences in the demographic characteristics of patients with and without leaks. Despite the fact that 87.5 percent of patients were women, this was not statistically significant (P-value:0.09). The mean± SD interval between surgery and leak is 14 ±18.4, with early and acute leaks being the most common. Failure of first-line management, stent migration, and esophageal stricture were the most common complications of leak management in our study. The mean length of hospital stays was 42.4 ±17.1 days, and the mortality rate was 12.5%.

Conclusions: Leak after LSG is a drastic complication associated with substantial morbidity and mortality if diagnosis and treatment are delayed. Depending on the patient's condition, location of the leak, and the time of diagnosis,; leak management may involve conservative, endoscopic, or surgical approaches. There are numerous measures that could be taken to reduce the leak incidence rate.

Keywords: Bariatric surgery; Sleeve Gastrectomy; Leak; Treatment; Outcomes

Introduction

Laparoscopic sleeve gastrectomy (LSG) is the most frequently performed bariatric procedure worldwide, accounting for over fifty percent of all primary bariatric procedures. Compared to RYGB or biliopancreatic diversion, the advantages of LSG include a shorter operative time, a low risk of complications, and its technical simplicity [1–3].

One of the most dreaded complications following a sleeve gastrectomy is a leak. According to the 2011 International Sleeve Gastrectomy Expert Panel Consensus Statement, based on data from 12,799 LSG, the leak rate was 1.06% [4]. However, the leak rate can vary from 0.46% to 3% for primary bariatric procedures [5–8] and more than 10% for revisional bariatric surgeries, and its management is very challenging [9–11].

Most frequently, leaks occur at the proximal end of the staple line at the esophagogastric junction (GEJ) or just beyond it [12,13[. Leaks can be classified according to their onset time as acute, early, late, or chronic (within seven days, one to six weeks, six to twelve weeks, and after 12 weeks, respectively) [7].

The clinical presentation can range from asymptomatic, which is only detected through radiological examination, to severe septic shock. The typical clinical manifestations of this condition are abdominal pain, tachycardia, tachypnea, fever, and leukocytosis [14]. It has been reported that tachycardia is the earliest [15], most common, and most significant clinical sign of a gastric leak [16].

Abdominal computed tomography (CT) with intravenous (IV) and oral (PO) water-soluble contrast is regarded as the best non-invasive method for detecting and confirming a gastric leak [17,18. [The management of postoperative leaks is controversial, but early diagnosis and aggressive treatment are necessary to reduce chronic gastric fistula, multiple organ failure, and mortality rates [19].

Therapeutic approaches for postoperative leakage include operative and nonoperative techniques. Nonoperative approaches include NPO, intravenous antibiotics, total parenteral nutrition (TPN), percutaneous drainage of intraabdominal collections, and endoscopic management including partially covered (PSEMS) or fully covered metallic self-expandable stents (FSEMS), clipping of the defect, endoscopic insertion of a pigtail, endoscopic injection of fibrin glue to treat fistula, and suturing devices [20,21].

Operative approach includes laparoscopic lavage, and drainage with or without primary leak repair; conversion of the LSG to a Roux-Y gastric bypass (RYGB), Roux-En-Y Fistulo-Jejunostomy (RYFJ), or in some cases a total gastrectomy with esophagojejunal anastomosis [22-24].
This study aims to determine the best option for managing gastric leaks, taking into account resolution rate, complications, intensive care unit (ICU) admission, conversion to other surgical techniques, and mortality. Furthermore, a management algorithm for post-LSG leaks will be proposed.

Materials and Methods

This study was conducted at the King Abdul-Aziz Specialist Hospital in Taif as a retrospective study. 1,049 patients with morbid obesity underwent bariatric surgery at our center between January 1, 2017 and December 31, 2021, with laparoscopic sleeve gastrectomy accounting for 90.3% (n=947) of these procedures.

Age, sex, BMI, preoperative comorbidities, leak rate, the interval between surgery and leak onset, location of leak, and the management lines and outcomes were collected. All procedures were performed laparoscopically at the King Abdul-Aziz Specialist Hospital in Taif by three bariatric surgeons. The patients were positioned in the reverse Trendelenburg position, with the surgeon standing between their legs. After establishing pneumoperitoneum with a Veress needle in the left upper quadrant, the five-trocar technique was employed. As an optical trocar, the first (12-mm) trocar is placed in the upper abdomen 15–18 cm below the xiphoid. Then, a 12-mm trocar is inserted in the left upper quadrant, while a 5-mm trocar is inserted in the right upper quadrant. A 5-mm trocar is then inserted in the left subcostal anterior axillary line. For the liver retractor, a 5-mm trocar is inserted in the sub-xiphoid. LSG was performed by separating the omentum from the greater gastric curvature using an energy-based device 2 to 4 centimeters proximal to the pylorus and continuing proximally into the angle of His. After completing the dissection of the greater curvature, the camera was moved to the 12 mm trocar in the left upper quadrant. Through the optical trocar, the first and second linear staplers are inserted. The gastric tubulisation started 4-6 cm from the pylorus. After firing the first stapler, a 36 Fr calibration bougie was inserted. The remaining staplers were fired cranially along the stomach's greater curvature with appropriate cartridges based on the stomach's thickness. The Methylene blue test is utilized routinely to detect leaks. Clips are applied to staple lines to ensure adequate hemostasis. A 12-mm trocar in the left upper quadrant is used to remove the resected stomach. No reinforcement of the stapler line is performed routinely. On the first post-operative day, patients were permitted clear fluids. For the next two weeks, they were restricted to a liquid-only diet. In typical circumstances, they were discharged home one day after surgery.

Statistics:
For the entry of data, an Excel spreadsheet was created. SPSS version 25.0 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses. The numerical data were expressed as the mean ± SD. For categorical variables, we used frequency tables with percentages. A p-value < 0.05 was regarded as statistically significant.

Results

From January 1st, 2018 to December 31st, 2021, 947 morbidly obese patients with a mean BMI of 44.8±6.8 kg/m2 underwent laparoscopic sleeve gastrectomy. The demographic characteristics of the patients are shown in Table 1. 397 (42%) of the patients who underwent LSG were men, while 550 (58%) were women. Participants had a mean age of 38.8±9.0 years. The most prevalent comorbidities were hypertension (7.3%) and diabetes mellitus (6.1%), while around 82.7% of the patients did not have chronic diseases.

Five out of 947 patients who underwent LSG in our hospital developed postoperative leaks (0.53%). Another three patients with staple-line leaks following sleeve gastrectomy were referred from other hospitals. Seven out of eight patients were women (87.5%). The mean BMI was 42.5±1.6 and the mean age was 34.1±7.3 years.

Table 2 displays a range of 5 to 59 days between surgery and leak, with a median ± IQR of 7±54 days. Early leak was the most frequent followed by acute leak (50%, and 37.5%, respectively) and the leak site was at the proximal third of the stomach (GEJ or beyond it) in all patients.

All patients presenting with leaks had abdominal pain, fever, and tachycardia. Three patients were referred from other hospitals with septic shock symptoms including fever, tachycardia, hypotension, abdominal pain, peritonitis, and leukocytosis. Those patients needed an urgent diagnostic laparoscopy with lavage and drainage.

An urgent abdominal and pelvic computed tomography (CT) with IV and PO water-soluble contrast was performed for all hemodynamically stable patients. Computed tomography has demonstrated abdominal collection or free fluid, free abdominal gas, and contrast extravasations into the abdominal cavity.

All stable patients were managed initially conservatively with NPO, fluid resuscitation, broad-spectrum intravenous antibiotics, and percutaneous drainage of the intra-abdominal collection. Except for two patients, who underwent CT-guided percutaneous abscess drainage, all patients underwent laparoscopic abscess drainage (Table 3).

As shown in Table 4, an urgent gastroscopy with insertion of an esophageal mega stent for 6–8 weeks was done in all stable patients (6 out of 8 patients, 75%) as a second-line of management.

After 6-8 weeks of stenting, the leak persisted in five patients, necessitating re-stenting in four (80%) patients and RYFJ in one (20%) patient, as shown in Table 5.

The leaking site has healed in four patients with endoscopic and conservative management. Three patients had persistent leakage despite conservative and endoscopic interventions and were managed by RYFJ (Table 6).
The complications of leak management are shown in Table 7. Two patients (25%) had pulmonary embolism (PE), one patient (12.5%) had transfusion-related acute lung injury (TRALI), one patient (12.5%) developed esophageal strictures, and another patient (12.5%) had stent distal migration and ulceration.

Table 8 demonstrates outcomes of the leak among our patients. Seven patients (87.5%) survived, while one (12.5%) died. One of the patients with septic shock had persistent tachycardia postoperatively and subsequently deteriorated clinically. Despite intensive care, she had multiorgan failure. She passed away on postoperative day 23 due to septic shock caused by intra-abdominal sepsis.

Table 1: The bariatric patients demographic characteristics

Variables	No leak Group (939)	Leak Group (N =8)	P-value
Age in years			
- Mean ±SD	38.8 ±9	34.1 ±7.3	0.139
BMI in Kg/m2			
- Mean ±SD	44.8 ±6.9	42.5 ±1.6	0.337
Sex			
- Men	396 (42.2%)	1(12.5%)	0.090
- Women	543(57.8%)	7 (87.5%)	
Comorbidities, No (%)			
- No Comorbidities	775 (82.5%)	8 (100%)	0.890
- HTN	69 (7.3%)	0	
- DM	58 (6.3%)	0	
- Liver cirrhosis	6 (0.6%)	0	

Values are presented as mean ± SD or number (%).
SD: Standard Deviation; BMI: Body Mass Index

Table 2: The characteristics of the leak.

Variables	Patients (N =8)
Interval between surgery and leak in days	
- Mean ±SD	14 ± 18.4
- Median ±IQR	7 ± 54
Time of Leak, No. (%)	
- Acute	3 (37.5%)
- Early	4 (50%)
- Late	1 (12.5 %)
- Chronic	0
Leak site, No. (%)	
- GEJ	7 (87.5%)
- Beyond GEJ	1 (12.5%)

Values are presented as mean ± SD, median ± IQR, or number (%).
IQR: Interquartile Range; GEJ: Gastroesophageal Junction

Table 3: First-line management of the leak of the included patients

Variables	Patients (N =8)
First-line, No. (%)	
- Laparoscopic abscess drainage	6 (75%)
- CT guided percutaneous drainage	2 (25%)
Failure of first line, No. (%)	
- No	1 (12.5%)
- Yes	(87.5%) 7

Values are presented as number (%).

Table 4: Second-line management of the leak

Variables	Patients (N = 7)
Second-line, No. (%)	
- Esophageal mega stent	7 (100%)
Failure of Second-line, No. (%)	
- No	1 (14.3%)
- Yes	6 (85.7%)

Values are presented as number (%).

Table 5: Third-line management of the leak

Variables	Patients (N = 5)
Third-line, No. (%)	
- Re-stenting	4 (80%)
- Roux-En-Y Fistulo-Jejunostomy	1 (20%)
Failure of Third-line, No. (%)	
- No	3 (60%)
- Yes	2 (40%)

Values are presented as number (%).

Table 6: Fourth-line management of the leak

Variables	Patients (N = 2)
Fourth-line, No. (%)	
- Roux-En-Y Fistulo-Jejunostomy	2

Table 7: Complications of leak management

Variables	Patients (N= 8)
General No. (%)	
PE	2 (25 %)
TRALI	1 (12.5 %)
Local No. (%)	
Failure of conservative and endoscopic management	
Stent migration	1 (12.5 %)
Esophageal stricture	1 (12.5 %)

Values are presented as number (%).
PE: Pulmonary Embolism; TRALI: Transfusion-Related Acute Lung Injury

Table 8: Outcomes of management of leak

Variables	Patients (N=8)
ICU admission, No (%)	3 (37.5%)
Mortality, No (%)	
- Survived	7 (87.5 %)
- Dead	1 (12.5 %)
Interval between diagnosis and leak control in days	
- Mean ±SD	79.1 ±50.8
- Median ±IQR	60 ±137
Hospital stays in days	
- Mean ±SD	42.4 ±17.1
- Median ±IQR	41 ±51

Values are presented as mean ± SD, median ± IQR, or number (%).

Discussion

In comparison to non-surgical interventions, bariatric surgery results in greater weight loss and resolution of obesity-related comorbidities, regardless of the procedure type used [25]. Laparoscopic sleeve gastrectomy is the most popular bariatric surgery [1]. It is technically easier to perform and has a lower rate of morbidity and mortality than Roux-en-Y gastric bypass or biliopancreatic diversion [5]. The most dreaded and severe complication of LSG is a gastric leak, which is associated with substantial and protracted morbidity [26]. The UK Surgical Infection Study Group proposed a definition of staple line leak; they define a leak as “the leakage of luminal contents from a surgical join between two hollow viscera.” A second definition suggested by the same group defines a leak as the “outflow of gastrointestinal contents through a suture line surrounding an organ.” Consequently, luminal content can exit through the wall or drain, or collect adjacent to the anastomosis [27].

Chen et al. [28] identified two major causes of staple line leaks: ischemic or mechanical issues [28]. Mechanical disruptions typically occur within the first 48 hours after surgery as a result of stapler misfiring or technical errors, such as improper staple height and stapling maneuvers [28]. It seems that leaks presenting between postoperative day five and seven are a result of ischemia [28]. Patients with distal stenosis caused by gastric body stricture, especially at incisura angularis or torsion are more likely to develop proximal leaks due to impaired gastric emptying and increased intragastric pressure.

Five of our patients, out of 947 LSG cases over a four-year period, had a staple-line leak, and three additional patients were referred to our center from other hospitals. In our study, the majority of patients with leaks were women (86.5%), with a mean BMI of 42.5±1.6 kg/m2 and a mean age of 34.1±1.6 years. This result is comparable to the findings of previous studies where a higher prevalence of leak among women (68-70%) and a mean BMI of (43.13 - 45.4 kg/m2) were identified [19,29].

Early detection of a leak is important because it permits early intervention, which has favorable patient outcomes [30]. A high index of suspicion is essential for diagnosing leaks, and a tachycardia greater than 120 beats per minute is a strong indicator of a leak and systemic compromise [31].

In the current study, the majority (50%) of leaks were diagnosed between one and six weeks; 37.5% were diagnosed within seven days; and 12.5% were diagnosed after six weeks. In our study, the median time between LSG and leak diagnosis was seven days. Similarly, Sakran et al. [19] reported a seven-day median time interval. Others, however, reported a median delay of 4.5 days between LSG and the diagnosis of a leak[32]. At

our center, intraoperative methylene blue test is routinely performed on all LSG patients, but no leaks have been detected intraoperatively. A negative methylene blue test does not however, rule out the possibility of leakage [20]. The GEJ was the most common site of leak in this study (87.5%). Comparable results were reported by Sakran et al. [19] where 75% of the reported leaks occurred near GEJ. This was explained by reduced vascular perfusion of this part of stomach as a result of aggressive dissection, particularly of the posterior attachments of the upper sleeve, or increased intragastric pressure in the gastric tube due to pyloric conservations [33].

The management of leaks following sleeve gastrectomy is difficult and lacks a clear standard algorithm [34]. In addition to NPO, broad-spectrum IV antibiotics, nutritional support, and proton pump inhibitors, laparoscopic abscess drainage was performed on 75% of patients with leaks, and CT-guided percutaneous drainage was performed on another 25%. These interventions were successful in 12.5% of patients but failed in 87.5%.

In this study, 7 (87.5%) of patients were treated with an esophageal mega stent as a second line leak treatment. One (14.3%) leak resolved after 6 weeks of stenting, while one patient died due to septic shock. The leak was persisting in five (71.4%) patients after 6 – 8 weeks of stenting and a stent was reinserted in four (80%) patients and RYFJ was done in one (20%) patient. The leak closure was achieved in 2 out of 4 patients after re-stenting without further treatment but 2 patients needed RYFJ due to persisting chronic leak. The endoscopic stent achieved leak closure in three (37.5%) patients. In concordance with our findings, Puig et al. evaluated the role of endoscopic stents in the treatment of staple line leaks after bariatric surgery and it was successful in only 19% [35]. Despite this, other studies found that 83.3% to 95.0% of patients treated with a stent had their leaks resolved [35-39].

In this study, we also evaluated the median time until healing of the leak, the median duration of hospital stays, the rate of admission to ICU, and the complications of leak management. The median time until healing and the duration of hospital stays were 60±137 and 41±51 days, respectively. The ICU admission rate was 37.5%, and finally, one patient died with a mortality rate of 12.5%. Rebibo et al. [40] reported a 1.2% mortality rate among patients with post-sleeve gastrectomy leaks, with a median healing time of 84 days [40]. The higher mortality rate observed in our series is likely due to the small sample size. The most common complications of leak management in our study were failure of first line management (50%), stent migration (12.5 %), and esophageal stricture (12.5 %).

There are several methods used to decrease the gastric leak after LSG. Meticulous dissection with gentle handling of tissues to reduce bleeding and thermal injury when using ultrasonic energy devices is crucial. The use of a bougie < 32 Fr may increase the risk of complications, while the use of a bougie > 36 Fr may lead to weight loss failure [7]. Adequate haemostasias, avoiding creating a spiral staple-line, and distal stenosis, especially at the level of incisura angularis is vital to avoid leak [7,15]. To reduce ischemic complications and prevent leaks, it is crucial to maintain a distance of at least 1–2 cm from the GE junction during the last firing [7,41].

This study has some limitations, including a small sample size and a single-institution, retrospective design.

Conclusion

Leak after LSG is a serious complication associated with substantial morbidity and mortality if diagnosis and management are delayed. A high index of suspicion and prompt detection is imperative. The management of leaks includes conservative, endoscopic, and surgical approaches based on the patient's condition, the time of diagnosis, and the location of the leak. However, it is associated with a prolonged hospital stay and a high cost.

Several measures, including gentle tissue manipulation, the use of larger bougie sizes, adequate hemostasis, avoiding stenosis, particularly at the incisura angularis, and avoiding the GE junction, could reduce the incidence of leaks.

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Conflict of Interest Statements:
The authors have no conflict of interest.

Algorithm for Management of Post-Sleeve Gastrectomy Leak (opposite page)

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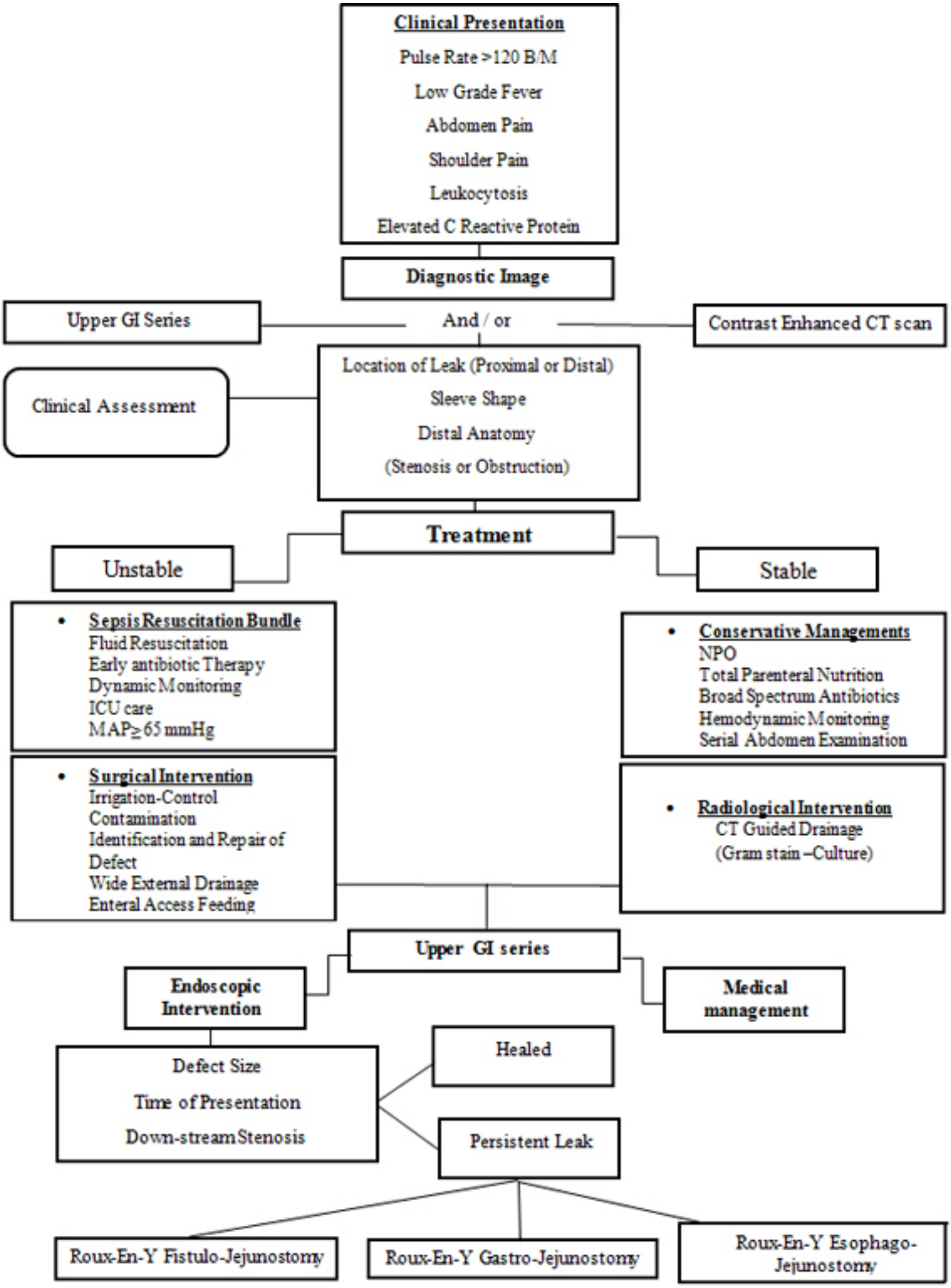
Clinical Presentation
Pulse Rate >120 B/M
Low Grade Fever
Abdomen Pain
Shoulder Pain
Leukocytosis
Elevated C Reactive Protein
Diagnostic Image
Upper GI Series
And / or
Contrast Enhanced CT scan
Clinical Assessment
Location of Leak (Proximal or Distal)
Sleeve Shape
Distal Anatomy
(Stenosis or Obstruction)
Treatment
Unstable
Stable
Sepsis Resuscitation Bundle
Fluid Resuscitation
Early antibiotic Therapy
Dynamic Monitoring
ICU care
MAP≥65 mmHg
Conservative Managements
NPO
Total Parenteral Nutrition
Broad Spectrum Antibiotics
Hemodynamic Monitoring
Serial Abdomen Examination
Surgical Intervention
Irrigation-Control Contamination
Identification and Repair of Defect
Wide External Drainage
Enteral Access Feeding
Radiological Intervention
CT Guided Drainage
(Gram stain –Culture)
Upper GI series
Endoscopic Intervention
Medical management
Defect Size
Time of Presentation
Down-stream Stenosis
Healed
Persistent Leak
Roux-En-Y Fistulo-Jejunostomy
Roux-En-Y Gastro-Jejunostomy
Roux-En-Y Esophago-Jejunostomy

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