Early Detection and Management of Leakage after Sleeve Gastrectomy

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Background: *Staple line leakage is the most feared complication after laparoscopic sleeve gastrectomy (LSG). The aim of this study was to describe the rate of leakage, the clinical presentation, early diagnosis and different lines of treatment in patients who develop gastric leaks following LSG.*

Patients and methods: *This study is a retrospective review of 849 patients who underwent LSG in AL Ahli Hospital (Qatar), and AL Amiri Hospital (Kuwait), between May, 2008 and May, 2013. The collected data included patients' demographics, operative and perioperative parameters.*

Results: *849 patients underwent LSG, 15 (1.8%) with gastric leak were identified; 9 females (60%) and 6 males (40%) with a mean ageof 39.5 years and a mean body mass index (BMI) of42.5 kg/m^2. Tachycardia was the most common presenting symptom of leakage (80%), followed by fever (60%), left upper abdominal pain (60%) and left shoulder pain (60%). Early detection of leakage (0-3 days) was found in 12 cases (80%) and intermediate detection (4-14 days) was found in 3 cases (20%). All leaks were found in the upper sleeve near the gastro esophageal junction (100%). Re-operation was performed for 6 cases (40%), percutaneous drainage for 6 cases (40%), endoscopic placement of stents in 9 cases (60%), and endoscopic insertion of clips in 3 cases (20%). The median time for leakage closure was 25 days (10-42 days) and the overall leakage related mortality was 3 cases (20%).*

Conclusion: *Staple line leakage is one of the complications following LSG (1.8%). Early leakage is more common than intermediate and late leaks. Tachycardia is the most common presenting symptom. Most leaks occur in the upper part of the sleeve. The management should be planned based on the clinical evaluation and time of diagnosis of leakage.*

Key words: *Laparoscopic sleeve gastrectomy – complications – gastric leak – morbid obesity.*

Introduction:

The prevalence of obesity has continued to increase in the last few decades. Currently it is estimated that there are greater than 1.7 billion overweight adults, and 300 million obese individuals worldwide.[1] The prevalence of obesity in children has increased in the last 15 years from 2% to 10% in boys, and from 2% to 9% in girls.[2] The ongoing increase in obesity may be associated with a multitude of factors including, but not limited to, genetics, diet habits, culture, and a general decline in exercise regimens.

Obesity is generally measured by body mass index (BMI) to estimate the degree of adiposity. Obesity is most commonly defined as a BMI> 30 kg/m^2, and morbid obesity is defined as a BMI >40 kg/m^2. Some significant obesity related comorbidities include type 2 diabetes mellitus (T2DM), hypertension, gastro esophageal reflux disease, degenerative joint disease, depression, and cancers.[3]

Although many dietary therapies are available, patients seem to be most responsive to surgical intervention. Current surgical strategies consist of laparoscopic adjustable gastric banding (LAGB), laparoscopic sleeve gastrectomy (LSG), laparoscopic Roux-en-Y gastric bypass (LRYGB), and laparoscopic biliopancreatic diversion with duodenal

switch (LBPD-DS).[4]

LSG is rapidly gaining momentum, both as a stand-alone and as a putative first-stage procedure in bariatric surgery since its introduction into the bariatric armamentarium.[5,6] Its major advantages are its relative operative simplicity, lack of anastomosis, absence of malabsorptive component, and induction of a favorable hormonal change facilitating weight loss through restriction and appetite suppression. It has reported lower morbidity and mortality rates than (LRYGB) and (LBPD-DS), thereby making it more appealing[7,8] It also has been used as a revisional option for patients with failed bariatric procedures such as vertical banded gastroplasty, silastic ring vertical gastroplasty, LAGB, and previous sleeve gastrectomy.[9-13]

Its complications consist mainly of staple-line bleeding, stricture (usually located at the middle or distal portion of the residual stomach), and the most severe and dangerous complication being staple-line leaks.[14] The reported gastric leak rates from the sleeve staple line are (1.4 – 2.5%) for primary sleeve gastrectomies and (16 – 20%) for re-operative surgery where a previous gastric operation has been performed.[15-18]

Gastric leakage occurs, most commonly, at the upper stable line near the gastro esophagealjunction.[19-20] This complication if not identified and treated quickly and aggressively, may lead to abdominal sepsis, which might progress either to chronic gastric fistula or to multi-organ failure and patient demise.[21]

Patients and methods:

From May, 2008 to May, 2013, 849 patients underwent laparoscopic sleeve gastrectomy(LSG) in two centers, the General Surgery Department of AL Ahli Hospital, Doha, Qatar and the General Surgery Department of AL Amiri Hospital, Kuwait. All patients had to agree with an informed consent after explanation of the procedure and its possible complications as well as the diet regimen during the post-operative period. Pre-operative investigations including ultrasound of the abdomen, coagulation profile, thyroid function tests, liver function tests, and serum cortisol level were routinely done for all cases. Prophylactic intravenous broad spectrum antibiotics with subcutaneous heparin, were given in all cases. Elastic stockings and pneumatic pump compression were applied during the procedure.

LSG operation technique:

The surgery was done in the French position in a 30 degrees reversed Trendlenburg's position. Pneumoperitonium was established to 15 mm Hg. Four trochars (12 mm) were used.The first trocar for placing the camera was inserted 15 cm distal to the xiphoid process. Another trocar was placed in the right lateral subcostal area for the liver retractor. Two trocars were located in the right and left upper quadrants. 36 French bougie was introduced by the anesthetist and adjusted close to the lesser curve till it reached the pylorus.

Starting 5 cm proximal to the pylorus, the greater curve of the stomach was freed from the gastro colic ligament and the short gastric vessels with the Harmonic ultrasound system up to the angle of His. To create the sleeve, the endo GIA stapler was fired along a line parallel to the lesser curve starting 5 cm proximal to the pylorus up to the cardia. The staple line was oversewn only along areas of bleeding. The excised portion of the stomach was extracted from the abdominal cavity by minimally enlarging the left upper quadrant incision and was subjected to histopathology examination. An intraoperative leakage test using methylene blue was done in all cases, and prophylactic tube drain was inserted along the staple line in all cases.

The surgical technique was the same in both centers, same bougie size (36-Fr), no buttressing materials were used, and over suturing the staple line was only applied over the bleeding points, but there was a slight variation between the two centers regarding the stapler manufacture choice and the staple height.

Gastrographin swallow was done routinely in all patients on the first and third

postoperative days to check patency and to rule out leakage. Data was collected and analyzed retrospectively (age, sex, BMI, co morbidity, previous bariatric surgery, operative and post operative data, the presence or absence of leakage, the interval between surgery and diagnosis of leakage and the interval between diagnosis of leakage and its closure). Weekly follow up was done in the outpatient clinic for two month, where full clinical assessment and follow up fluoroscopy study were performed. Statistical analysis of the collected data was performed using SPSS software.

Results:

849 patients underwent LSG in both centers between May 2008 and May 2013. Among these 849 cases, we identified 15 (1.8%) with gastric leakage. The 834 cases who underwent LSG and did not develop postoperative leak were considered as the control group, and the other 15 cases who developed post-operative leak were considered as the leak group.The leak group patients were 9 females (60%) and 6 males (40%), their mean age was 39.5 years and their mean body mass index (BMI) was42.5 kg/m^2.

Twelve (12) patients in the leak group (80%) had previous LAGB, while 84 patients in the control group (10%) had previous LAGB. This difference in proportion is highly significant (P>0.005), implying an increased risk for leak in patients with previous bariatric surgery. Co-morbidities in the leak group included hypertension in 9 patients (60%), dyslipidemia in 12 patients (80%), obstructive sleep apnea in 6 patients (40%) and type 2 diabetes mellitus in 6 patients (40%). Patient demographics and preoperative data were demonstrated in **Table (1)**.

Intra operative leakage test was done routinely for all cases using methylene blue dye but it did not detect the leakage in any of the cases.

The clinical presentation in the leak group included tachycardia in 12 cases (80%), fever in 9 cases (60%), left shoulder pain in 9 cases (60%), left sided abdominal pain in 9 cases (60%), and left sided chest pain in 6patients (40%). **Table (2)**.

An upper GI series using water soluble contrast (Gastrographin) was used in all patients on the first and third post operative days and diagnosed the leak in 12 cases (80%), the remaining three cases were not diagnosed early and were discharged home on the fourth post operative day, then presented for follow up in the outpatient clinic (7 to 10 days after discharge) with left upper abdominal pain and tachycardia. Gastrographin study was repeated and proved the leak. **Figures(1,2)**.

In all cases, the leakage was in the upper part of the sleeve near the gastro-esophageal junction (100%). Re-operation was performed in 6 cases (40%) where thorough laparoscopic washout and drainage of theabdomen with insertion of wide bore drains, and with direct suturing of the site of the leak were performed in three of these 6 cases where the tissues were healthy.

The other treatment options included percutaneous drainage under CT guide in 6 cases (40%), endoscopic placement of stents in 9 cases (60%), **Figures (3,4,5,6)** andendoscopic clips insertion in 3 cases (20%), **Figure (7)**.

All cases had intravenous broad spectrum antibiotics, proton pump inhibitors (PPIs), prophylactic subcutaneous heparin, NPO, and total parenteral nutrition (TPN). The stents were removed after 4 weeks.

The median time for leak closure was 25 days (10-42 days). The overall leak related mortality was 3 patients (20%) who died in the early post operative course, first one due to pulmonary embolism in spite of pre- and post-operative prophylactic heparin, the other two cases developed severe sepsis with multi-organ failure in spite of early diagnosis (third post operative day), immediate laparoscopic washout and insertion of wide bore drains. **Table (3)** shows the characters of the leak and the lines of its management.

Discussion:

Laparoscopic sleeve gastrectomy (LSG) is gaining popularity as a bariatric option with short and midterm results similar to those for laparoscopic Roux-en-Y gastric bypass but with lower morbidity and mortality

rates.[22] The most common and important complications after LSG are: staple line bleeding, strictures, and the most severe, dangerous complication being staple line leakage.[23]

Staple line leakage after LSG ranges from (0.7 – 5.3%) according to different studies, **Table (4)**, and its clinical presentation ranges from mild micro leaks, that may cause peri sleeve abscess and chronic fistula, to an acute abdomen with sepsis, hemodynamic instability, multi organ failure, and rarely death(24). In our study, the percentage of leak was 1.8%.

Baker suggests two main categories of leaks, classic ischemic leak that tend to appear between 5-6 days after surgery and mechanical leakthat tends to appear within two days after surgery.[36] In our study, early leak was detected in 12 cases and intermediate leak was detected in 3 cases.

The cause of gastric leak is indicative of some abnormality or failure of normal healing process of tissue. There is a general agreement that local risk factors contributing to a leak are impaired suture line healing due to staple dehiscence, poor blood flow, and infection. These risk factors contribute to decrease in oxygen and subsequent ischemia to tissues.[37]

Atkins et al,[38] demonstrated that the patients treated with the more restrictive (40-Fr) bougie experienced a significantly greater weight loss and more co-morbidities than those treated with a (50-Fr) bougie. In our study we used 36-Fr bougie for all cases.

The esophago-gastric junction has been reported as the usual site of leak after LSG. Particular attention should be paid to this area at the time of staple firing. It is important to use staples of an adequate height and avoid stapling the esophagus.[39] We noticed that the leak occurred in the upper part of the sleeve near gastro esophageal junction in all of our cases.

Routine or selective use of intraoperative diagnostic methods is controversial. Intraoperative endoscopy with air leak testing and trans- gastric dye injection have been used by some authors to detect a leak during the initial surgery. The rationale behind the routine use of these tests intraoperatively is to detect technical leaks (mechanical leaks) at a time when tissues are viable and most amenable to repair by re-stapling or suturing. A negative methylene blue test does not eliminate the possibility of a leak.[40] In our study, we routinely used intra operative methylene blue leak test which did not detect any leak in all of the cases, while 15 cases developed leakage later on and were diagnosed by gastrographin fluoroscopy study.

The clinical presentation of leak can vary widely between totally asymptomatic patients diagnosed with routine imaging study (gastrographin) postoperatively[40] to the symptoms and signs of septic shock including fever, abdominal pain, peritonitis, leukocytosis, tachycardia and hypotension.[41]

Dakwar et al stated that fever is the most important clinical factor in the diagnosis of gastric leak post sleeve gastrectomy.[23] Others stated that tachycardia is the earliest and most important and constant clinical finding indicating presence of leak, and tachycardia >120 beats/minute is a powerful indicator of leak and systemic compromise.[19]

Early leaks usually present with sudden abdominal pain, accompanied with fever and tachycardia in most cases, while late leaks tend to present with insidious abdominal pain commonly associated with fever.[42] We observed that the most common presentation was tachycardia, followed by fever, left upper abdominal pain andleft shoulder pain.

Routine gastrographin swallow test 24-72 hours post operatively is still an area of large debate. While Wahby et al, have shown its inability to detect post operative leak, they still recommend it to be done routinely, especially that it can detect other complications like strictures and anatomical consequences of the sleeve.[40]

CT scan of the abdomen with intravenous and oral water soluble contrast is considered to be the best non-invasive modality for detection and confirmation of a gastric leak.[43] This superiority of CT scan is questioned by some investigators, lying on the fact

Figure (1): Normal postoperative fluoroscopy study.

Figure (2): Post operative fluoroscopy study showing leakage in the upper part of the sleeve. This patient had previous spine fixation with metal screws.

Figure (3): Stent before insertion.

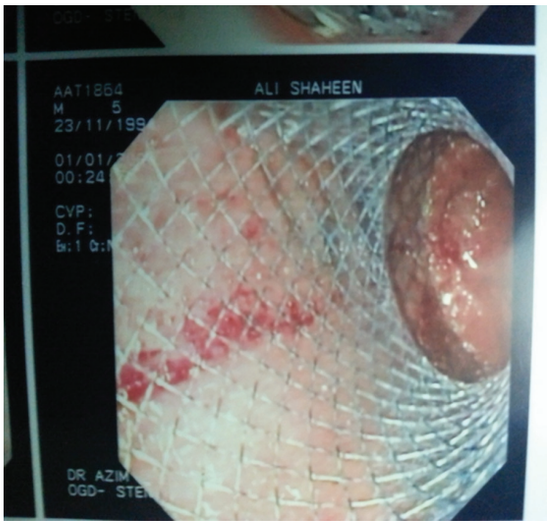

Figure (4): Endoscopic view of the stent after insertion.

that obesity and large body dimensions (BMI <50) produce artifacts that reduce the image quality and also produce technical difficulties that may overcome the ability of the framework to support and thus they recommend gastrographin swallow instead.[29] In our series we performed routine gastrographin swallow for all cases on the first and third post operative days.

The management of leak following LSG imposes a lot of controversies and difficulties in the adoption of a standard algorithm. Based on the first international summit for sleeve gastrectomy, the treatment may include early oversewing and drainage (open or laparoscopic), endoscopic clipping, stenting or using fibrin glue, sometimes the use of Roux loop or totalgastrectomy as the last resort.[44] In unstable patients upon presentation, prompt surgical intervention by laparoscopic or open means is recommended for washout and drainage, at least, that may be coupled with debridement and suturing of the orifice if the condition of the patient and the tissues,

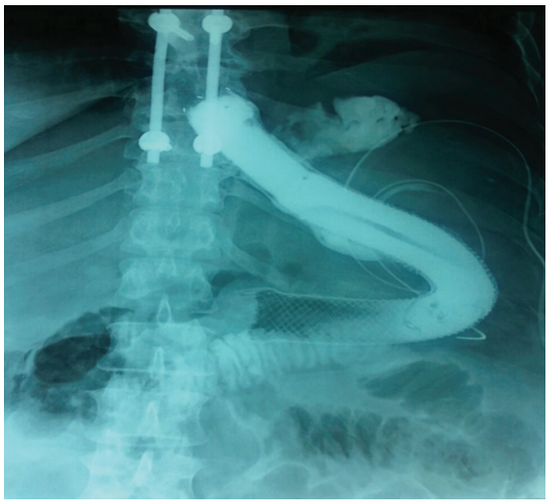

Figure (5): Post stent insertion fluoroscopy study showing distal migration of the stent with persistent leakage in the upper part.

Figure (6): Stent after removal.

Figure (7): Endoscopic clip insertion.

Table (1): patient demographics and preoperative data.

Parameters	Control group (n=834)	Leak group (n=15)	p value
Mean age (years)	39.8	39.5	>0.05
Mean BMI (Kg/M2)	42.1	42.5	>0.05
Males (%)	34%	40%	>0.05
Females (%)	66%	60%	>0.05
Hypertension (%)	52%	60%	>0.05
Dyslipidemia (%)	68%	80%	>0.05
Sleep apnea (%)	28%	40%	>0.05
Type 2 diabetes (%)	27%	40%	>0.05
Previous LAGB (%)	10%	80%	<0.005

and the skills and experience of the surgeon permit.[40] This immediate surgical intervention in early leaks showed better outcome than the more conservative approach. While the adoption of a more conservative approach for intermediate and late leaks in clinically stable

Table (2): Clinical presentation in the leak group.

Symptoms and signs	Number of cases	Percentage
Tachycardia	12	80%
Fever	9	60%
Left shoulder pain	9	60%
Left abdominal pain	9	60%
Left chest pain	6	40%

Table (3): Characters of the leak and lines of management.

Character	Number	Percentage
Site (upper part)	15	100%
Early detection (0-3 days)	12	80%
Intermediate detection (4-14 days)	3	20%
Laparoscopic drainage	6	40%
laparoscopic suturing	3	20%
Percutaneous drainage	6	40%
Endoscopic clip insertion	3	20%
Endoscopic stents	9	60%

Table (4): Percentage of staple line leaks after LSG in different studies.

Authors	Number of patients	Number of leaks	Percentage of leaks	Years
Lacy et al[26]	294	11	4%	2010
Daskalakis et al[25]	230	10	4.3%	2011
Bellanger and Greenway[27]	529	0	0%	2011
Simon et al[28]	139	5	3.6%	2011
Jurowich et al[29]	45	4	8-9%	2011
Gagniere et al[30]	102	7	6.9%	2011
Albanopoulos et al[31]	353	12	3.4%	2011
Weiner et al[32]	686	12	1.7%	2013
Sakran et al[22]	2834	44	1.5%	2013
Albanopoulos et al[33]	90	2	2.2%	2012
Gill et al[34]	116	0	0%	2012
Spyropoulos et al[35]	208	12	5.8%	2012

patients is more reasonable with adequate hydration, PPIs, NPO, parenteral nutrition, broad spectrum antibiotics, and percutaneous drainage of any collection.[45] Weekly follow up by gastrographin swallow should be done, and if the leak does not heal after 2 weeks, endoscopic management can be considered with wide range of success.[46,47]

Over the scope clips (OTSC) have more promising results, but they are limited for very small mucosal defects and micro perforations, and are inefficacious in inflammatory or edematous mucosa, and demanding technical skills.[48] Sealant materials including fibrin glue and cyanoacrylates were used by some authors.[49] Nguyen et al,used self expanding

stents with a success rate of 100%.[47]

A complete endoscopic approach was also suggested by Bege et al,[49] without the need for any surgical intervention that consists of three stages of endoscopic treatment: Washout and drainage using natural orifices transluminal endoscopic surgery (NOTES), diversion using a stent, closure with glue or clips.

In our study, 12 cases were diagnosed early and the remaining 3 cases were diagnosed later during routine follow up in the outpatient clinic. Re-operation was performed in 6 cases in the form of laparoscopic washout and insertion of wide bore drain, laparoscopic suturing was done in 3 of them, 6 cases required CT guided drainage. Endoscopic clip insertion was done in 3 cases, and endoscopic placement of stent was done in 9 cases. The median time for leak closure was 25 days (10-42 days).

Conclusions:

The apparent simplicity of LSG hides a number of complications; staple line leakage is one of them (1.8%). Early leak is more common than intermediate and late leaks. Tachycardia is the most common presenting symptom followed by fever, left upper abdominal pain and left shoulder pain. All leaks are detected in the upper part of the sleeve near gastro esophageal junction. Its management is variable with no standard algorithm to follow, but it should be planned based on the clinical evaluation and time of diagnosis. The absence of clear approach and guidelines for the management of gastric leaks, emphasizes the importance of prophylaxis.

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