



## Standardized Treatment of Leakage Post-Sleeve Gastrectomy, Techniques to Decrease Leakage Rate, Correlation of Certain Variables with Patient Remission, Morbidity and Mortality

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**Abstract: Introduction:** Laparoscopic sleeve gastrectomy (LSG) is the most common performed bariatric surgery. Gastric leak is a known detrimental complication after LSG and is the second most common cause of death after bariatric surgery with an overall mortality rate of 0.4%

**Objective:** This study aims to share outcomes of our post laparoscopic sleeve gastrectomy (LSG) leak management algorithm, including the rate of resolution, complications, admission to the intensive care unit, conversion to other techniques, and mortality. This study also aims to identify techniques that decrease leakage rate, to find if there is any correlation of certain variables with patient remission, morbidity and mortality and to determine if any factor can predict the resolution time.

**Methodology:** A retrospective study of prospectively collected data of patients with post LSG leak managed in Innova Medical center was done.

**Results:** The number of patients studied in the research was 1200 and Out of the 1200 cases of sleeve gastrectomies done in Innova Medical Center, 11 cases of gastric leaks occurred. The first 4 cases occurred in the first 100 operations where the oversewing technique was not adopted. When Oversewing technique was started with enforcement of staple line with running sutures from the Gastroesophageal (GE) junction to the pyloric area the rate of gastric leaks dwindled. Other management techniques used were: Gastric Lavage, Drain placement, oversewing, stent placement, conservative management (Broad spectrum antibiotics, TPN, NPO, IV hydration), Conversion to Roux en Y & Total gastrectomy. There was remission seen in 10/11 patients (90.9%) following the treatment strategy used, with 1 fatal case.

### Conclusion:

1. Staple line reinforcement with sutures dramatically reduces the leakage cases according to our material.
2. Early Leaks are probably related to surgical malpractice.
3. Intermediate leaks have better outcome than late leaks
4. Staple line leaks are not correlated to age, sex, BMI.
5. Feeding Jejunostomy has better control of nutritional status of the patient than parenteral nutrition.
6. Stenting has no evident efficacy in controlling gastric leakage.
7. Gastric Leak is not 100% preventable but can be cured with 95% efficacy if the admission is on time.
8. Admission On time, Re-laparoscopy,

drainage, no touch technique & feeding jejunostomy is the standardised treatment for Leakage that should be adopted.

**Keywords:** Sleeve, Gastrectomy, leakage, Management, Bariatric, Surgery.

**Introduction:** Leakage in medical terms can be defined as seepage of luminal contents from a surgically sutured area ,between two hollow viscera.[1] Major symptoms of leak include fever, tachycardia (usually above 120 beats/min) , acute abdominal pain (if acute leakage) / chronic abdominal pain (if chronic leakage). However Fever & Tachycardia are more significant findings when compared to abdominal pain. Besides this it has been found that the site most vulnerable to leakage after sleeve gastrectomy is gastro-esophageal junction [2]

Leaks can be classified on the basis of a. etiology b.Localization c.time of occurrence d.radiologic interpretation.

**On the basis of etiology they can be classified into:**

**Mechanical leaks:** These are those that can be caused by stapler misfiring or direct tissue injury. They tend to occur within 2 days post-operation.[3]

**Technical leaks:** These are those that are caused by a wrong technique that was being opted at the time of operation to overcome a situation.

**Ischemic leaks:** These are those that are caused by delayed wound healing due to ischemia thereby the weak staple line gets overpowered by the increased gastric pressure and the leak results. [3]

**On the basis of Localization, they can be classified into:**

**Type I:** Indicates a leak that is well localized, there is no dissemination into pleural or abdominal cavity and there are no systemic manifestations.

**Type II:** Indicates dissemination into abdomen and pleural cavity and there are other systemic manifestations along with it.[8]

**On the basis of time of occurrence, they can be classified as:**

**Early:** Those that occur from 1-4 days post-operation. They usually present with sudden abdominal pain, fever and tachycardia.

**Intermediate:** Those that occur 5-9 days post-operation.

**Late:** Those that occur 10 or more days post-operation. They usually present with slow growing abdominal pain and fever. [7]

**On the basis of radiology they can be classified into:**

**Type A Leaks:** In these there are micro-perforations present but there is neither radiological evidence nor clinical findings.

**Type B Leaks:** There is radiological evidence of leak, but no clinical symptoms associated with it.

**Type C Leaks:** In these, both radiological and clinical evidence are present. [10]

**Based on clinical presentation, gastric leaks are 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 a more generalised dissemination into the pleural or abdominal cavity with or without appearance of contrast medium in any of the abdominal drains. [8,9]

Leaks can be detected or confirmed in several ways and they are

1. Methylene Blue test
2. Gastrograffin swallow test (which is done 24-72 hours post-operative)
3. Air leak test
4. Intra-operative Endoscopy
5. CT of abdomen with IV and per oral water soluble contrast.

### **Patient Presentation**

Patient can present with a wide array of presentations from being totally asymptomatic (diagnosed with imaging studies post op), to signs and symptoms of a septic shock including fever, abdominal pain, peritonitis, leukocytosis, tachycardia, hypotension etc.

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 [23]

Unexplained fever and tachycardia post op should raise the index of suspicion of a possible complication and push the surgeon to perform further radiological investigations to Rule out the presence of leak [13].

As for Csendes et al [13] and Dakwar et al [20], fever is the most important clinical factor in the diagnosis of gastric leak post sleeve gastrectomy. Others agree that tachycardia is the earliest[9], and most important and constant clinical finding indicating the presence of a gastric leak [21], and a tachycardia above 120 beat/min is a powerful indicator of leak and systemic compromise[22].

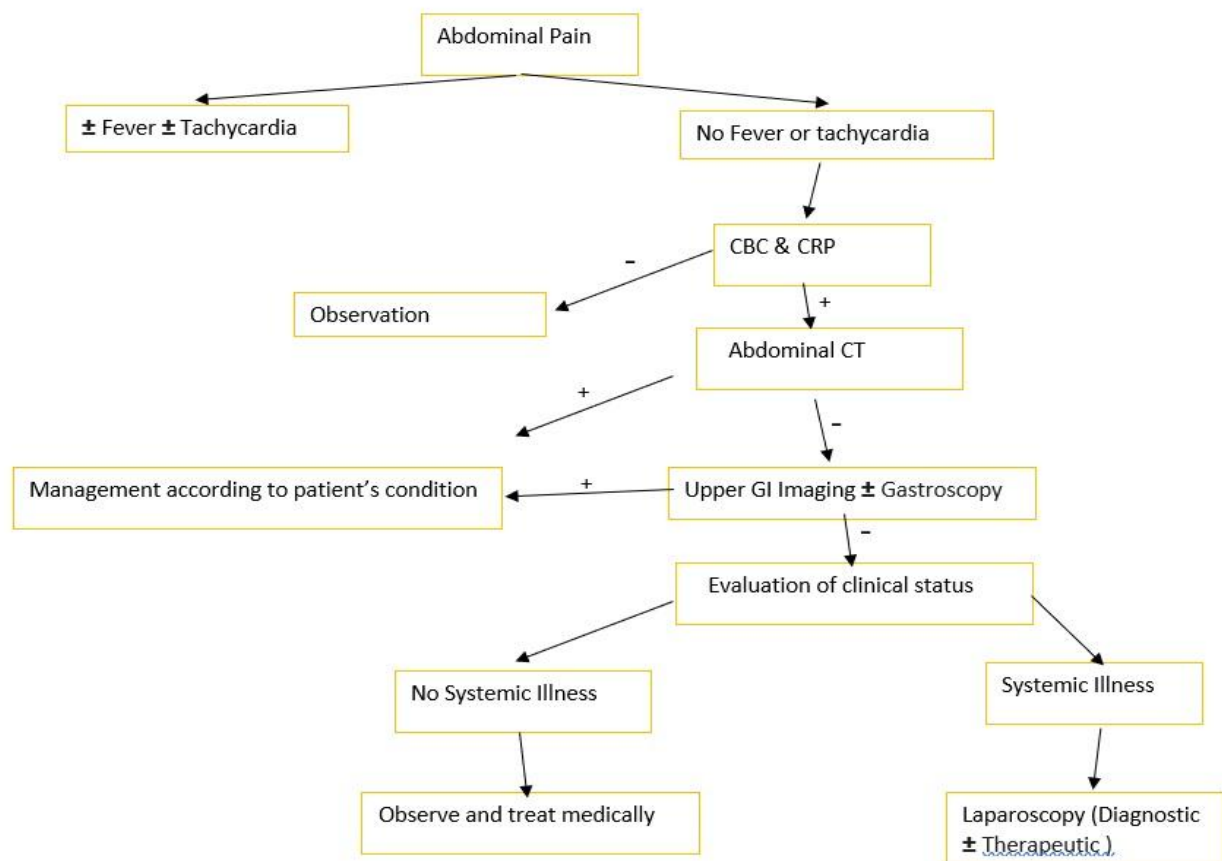
### **Diagnostic Workup**

Laboratory studies including CBC, CRP are neither sensitive nor specific, and they rarely contribute to make a diagnosis [24].

Computed tomography (CT) of the abdomen with IV and PO water soluble contrast is considered as a part of the diagnostic workup of patients with suspected leak, with the presence of abdominal collection or free fluid, extravasation of contrast into the abdominal cavity or the drain tube, or persistent pneumoperitoneum as diagnostic findings of leak or fistula[25].

CT is considered to be the best non-invasive modality for detection and confirmation of a gastric leak [13,23,26]. These results are also supported in another multi-center experience showing that CT had the highest detection

rate of gastric leaks in up to 86% of patients [24]. This superiority of CT scan over other invasive and non-invasive modalities is questioned by some investigators, lying on the fact that obesity and large body dimensions [body mass index (BMI) over 50] produce artifacts that reduce the image quality, added to the technical difficulties imposed by the large body weight and dimensions that may overcome the ability of the framework to support and thus they recommend upper gastrointestinal (UGI) radiography and endoscopy instead[27].



**Figure 1. Algorithm for the workup of abdominal pain post sleeve gastrectomy, when a leak is suspected. CBC: Complete blood count; CRP: C-reactive protein; CT: Computed tomography**

**Management of leakage** is according to the condition of the patient. The leaks on an average take more than 6 weeks (average 45 days) to heal. [13]

**If the patient's condition is unstable**, management includes Surgical intervention (open/laparoscopic) to drain the leakage and suturing the leakage sites. [9,11]

**If the patient's condition is stable**, management includes adequate hydration, nutritional support, broad spectrum antibiotics, proton pump inhibitors, percutaneous drainage, nil per os. If with this management, leakage doesn't stop after 2 weeks or more, endoscopic management is considered. [9,11,12,13]

Endoscopic Management includes a 3 stage process. In the first stage there is washout and drainage using NOTES (Natural Orifice Trans-luminal Endoscopic Surgery). The second stage involves diversion using a stent and the third stage involves closure with glue/clips. The closure technique and exclusion technique employed in endoscopic management are as follows

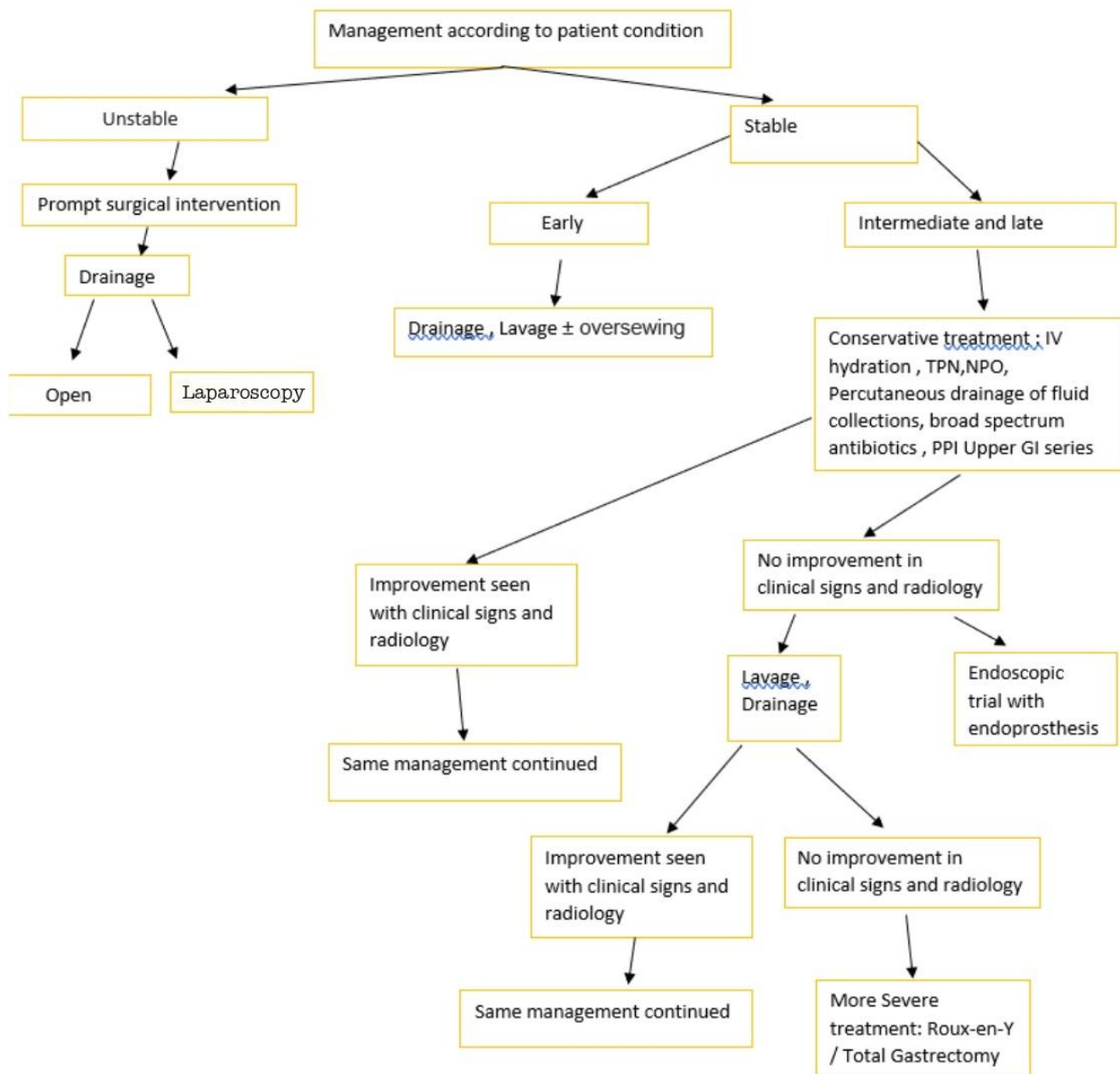
#### Closure technique:

- Endoclips: OTSC (Over The Scope Clips) are useful for very small mucosal defects and other micro-perforations but they are not found to be effective on inflamed tissue
- Sealants: Fibrin glue and Cyanoacrylates form this group of materials. Fibrin glue plugs the defect and it is also a fibroblast promoter causes fast wound recovery. [15,16]

#### Exclusion Technique [Stents]:

Stents are used in this technique, which expand the lumen of the stomach and decrease the intraluminal pressure which is important factor for gastric leak. [19] Besides this, stents are employed with drugs that fasten the wound repair.

When every potential modality ends up as a failure, Roux limb or total gastrectomy can be adopted as the last resort.



**Figure 2 : Algorithm for the management of a gastric leak post sleeve gastrectomy. NPO: Nil per os; IV: Intravenous; PPI: Proton pump inhibitor; TPN: Total parenteral nutrition**

**Objective :** This study aims to share outcomes of our post laparoscopic sleeve gastrectomy (LSG) leak management algorithm, including the rate of resolution, complications, admission to the intensive care unit, conversion to other techniques, and mortality. This study also aims to identify techniques that decrease leakage rate, to find if there is any correlation of certain variables with patient remission, morbidity & mortality and to determine if any factor can predict the resolution time.

### Methods & Results:

A retrospective study of prospectively collected data of patients with post LSG leak managed in Innova Medical center was done.

### Case Reports

Out of the 1200 cases of sleeve gastrectomies studied in the research, 11 cases of gastric leaks occurred (a ratio of 1:109). The decrease in the number of leakage cases over the years has been attributed to several factors and methods adopted.

The 1<sup>st</sup> four cases of leakage occurred in the first 100 operations where the oversewing technique was not adopted. All of the leaks in the 11

cases were at the GE junction at the last staple area. 10 of these occurred 6-12 days after surgery (intermediate leaks) only 1 occurred after 50<sup>th</sup> day (late leak).

When Oversewing technique was started with enforcement of staple line with running sutures from the Gastroesophageal (GE) junction to the pyloric area the rate of gastric leaks fell down. Technique of oversewing included 1<sup>st</sup> and last staple at GE junction using sero-serous sutures whereas in all other instances transmural technique was employed.

In 1<sup>st</sup> two cases of leak, Mega stent was used but it was not found to be useful because of migration and subsequently the stents were removed after 4<sup>th</sup> day and 2nd week in the respective cases. Later on Re- laparoscopies were done to put feeding jejunostomies.

All of the patients with suspected leakage underwent immediate surgical exploration at the time of readmission in the hospital. Clinical signs in most of the cases of leakage were found to be : Shortness of Breath ,fever , Abdominal pain ,tachycardia, septic shock but without generalized peritonitis.

At the time of surgical exploration, diagnostics (Methylene blue test, airway leak test) were being used to find the leak site and in all cases the leak site was being located and an attempt to oversew was not made. Drainage of subsequent areas (perigastric or subphrenic area ) was done and in 3 cases there was a need to put drains also in right subphrenic and douglas area.

In 9 cases of 11, feeding jejunostomies were placed 50 cm from the ligament of Treitz. Initial endoscopy at the time of operation had been performed in all cases.

Concerning the time of healing for leaks – it took 40-70 days ( average -55 days) and usually the patients stayed in the hospital for not more than 3 weeks and not more than one intervention was required for the intermediate leaks because no further complications like abscess formation and others occurred.

Of all the gastric leak cases studied in the research, 4 were women and 7 were men summing up to total 11 cases. Out of the 11 cases, one death (man) was accounted. The leakages were classified as intermediate leakage in 10 cases and Late leakage in 1 case.

**Year 2014:** There were 3 leakage accounted in this year.

- **Pt 1 Management :** Relaparoscopy + esophagoduodenal stent + Drain placement + Feeding Jejunostomy
- **Pt 2 Management:** Relaparoscopy + esophagoduodenal stent + antibiotics + TPN + Roux en Y bypass -----> complications ----> total gastrectomy with creation of esophagojejunostomy on Roux en Y limb + Enterostomy.
- **Pt 3 Management:** Relaparascopy + Drain placement + Esophagoduodenal stent

**Year 2015:** 1 fatal case of gastric leak was accounted in this year

- **Pt 4 Management:** Relaparoscopy + Drain placement .The patient was sent to Turkey for further treatment because of his deteriorating condition.

**Year 2016:** 2 leakages were noted in this year.

- **Pt 5 Management:** Treatment : Only medications No surgical procedure was done or drains were placed.
- **Pt 6 Management:** Relaparoscopy + Drain placement + enterostomy.

**Year 2018:** 2 cases of leakage were present in this year

- **Pt 7 Management:** Relaparoscopy + Drain Placement
- **Pt 8 Management:** Relaparoscopy + drain placement + enterostomy

**Year 2019:** 3 cases of leakage were identified this year

- **Pt 9 Management :** Relaparoscopy + drain placement + Entererostomy

- **Pt 10 Management** : Relaparoscopy + drain placement
- **Pt 11 Management** : Relaparoscopy + drain placement + Enterostomy.

### Cases with Intermediate leaks:

10/11 Cases of leakage were intermediate leaks and the treatment of them were standardized according to latest protocol and standards.

1<sup>st</sup> step of treatment (if sepsis was present and leakage of contrast in abdominal cavity was noted on X-ray / CT ) was to do surgical exploration.

In only 3/10 intermediate leak cases, leaks were suspected because the patients readmitted to the hospital 1 week post-surgery and these cases were with fever, tachycardia and no signs of septic shock.

Initially It seemed to be a systemic inflammatory response reaction because of which antibiotics were administered along with dust protection and mild diet, however no leaks on X-ray or CT scan or on endoscopy were found. But as fever and tachycardia persisted for more than 10 days micro-leaks were suspected (which did not become an issue for another surgery).

In other cases systemic inflammatory response syndrome with signs of septic shock was suspected, when CRP – 200 or more, leukocytosis and left shift of neutrophils was noted along with pain. X-ray or CT scan was used if patient was not too overweight and immediate laparoscopy was done if these modalities didn't help. Eventually All of these cases were positive for leaks during laparoscopy.

**Treatment** option was immediate re-laparoscopy if there was **triad (abdominal pain+fever+tachycardia)** along with shortness of breath and signs of septic shock. The exploration opted was both laparoscopic & endoscopic and No-Touch Technique (NTT) to the fistula was opted at the septic stage and drainage with 2 or more drains was done (perigastric & left subphrenic area). Number of drains was not limited as, if there was some infection/leakage to other parts of the abdomen that developed during or before surgery, they required subsequent drainage too.

In 2 cases, stents were not employed because stent placement was intolerable and stent migration could occur, so gastric fistula to the drain was made.

The patients were given nutritional nourishment after surgery via feeding jejunostomy in 8/10 cases.

In the first 4 days feeding jejunostomies work as a decompression system for the intestine because of post-surgical ileus that occurs in the patients because of irrigation and washing and unpreparedness of the patient for the surgery. 1<sup>st</sup> four days these feeding jejunostomies were open at the mouth end and they worked as decompression system for the intestine, preventing the intestinal contents from going up to the stomach.

For the first 10-12 hrs nasogastric intubation was used. Patients were put on a zero diet & parenteral nutrition was started immediately after surgery. Meanwhile enteral nutrition was started on the 4<sup>th</sup> day after surgery when intestinal movement and recanalization occurred. Special bolus , nutrients and protein solutions via enteral route were provided. Concerning antibiotic therapy in all cases samples for bacteriology were taken but empirically Imipenem and vancomycin combination along with anti-fungal medications were started. For gastric protection H2 blockers and PPI were used and the function of other organs like liver , kidney , lung were assessed for distress along with red blood cell levels and Hb levels . Hb level was found to be less than 10 in 3 cases for which blood transfusion was opted.

Patients were not bed bound 24 hours after surgery and physical activity was initiated by the patients. All of the patients stayed at least 3 weeks but 1 stayed for 1 month because of sub-febrile temperature. In all of these cases there was a rapid decrease in intoxication , improvement of WBC count , improvement of CRP and improvement of kidney function & acid base disorders. In all of the cases any kinking or twisting was not found indicating no evidence of surgical malpractice, which means leaks are not 100% preventable even if the surgery was performed with precision.

**Statistically**, without oversewing, there were 4% leaks (4 cases in 100) and after oversewing there were only 0.63% leaks (7 cases in 1100) So this indicates that enforcement of staple line dramatically reduces the leak but chances are still that they might occur.

**Case with Late Leak:** A complicated case was of a patient with BMI >80 (visceral type obesity) who manifested with leak on the 50<sup>th</sup> day post-operation. The patient was an alcoholic but had left alcohol 6 months prior to the operation and was on a modest diet and on preoperative rehabilitation course. Weight of the patient was 270 kgs and despite diet and alcohol abstinence he had fatty liver. 1<sup>st</sup> month post-surgery the patient lost 60 kgs. The patient developed Wernicke's encephalopathy, continuous vomiting for which the patient was checked by endoscopy and X-ray & no obstruction, twisting or kinking was found.

When diplopia was accounted, vitamin B1 (thiamine) supplementation was provided after which there was a decrease in the signs and symptoms but the temperature remained high. Besides this, mild pain in left shoulder was also noted. Endoscopy was done again and a small ulcer at the GE junction where the staples were seen, was found. On X-ray, localized leak without any abscess formation and inflammation or peritonitis was noted. So the patient was put on a zero diet with total parenteral nutrition and antibiotics were started and a stent was put.

2 weeks into stenting, the patient couldn't tolerate stent because of reflux, so the situation obliged the removal of the stent. The patient's signs and symptoms improved after stent removal with no signs of septic shock but then later he developed pulmonary embolism because of which he was sent to ICU for 10 days and he recovered without any complications and He was then added on a soft diet. After 3 months he came to the emergency department with onset of peritonitis and on CT he was found to have air in abdomen. On laparoscopy it was found that at the site of leakage there was a chronic fistula of the remnant stomach and attempts were made to reduce the pressure inside the remnant pouch. Then a conversion to Roux en Y bypass was being done. The patient had leakage from the fistula for about 2 weeks after which it reduced. But liver abscesses developed later on that were drained percutaneously.

1 month post-Roux en Y bypass surgery, at the time when the patient was going to be discharged from the hospital, the patient started to have peptic ulcers at the site of GI anastomosis of Roux en Y pouch that started to bleed. Endoscopists tried to stop it 2 times by coagulation, ablation or injecting adrenaline around the ulcer but attempts failed and ulcers continued to recur.

Then the patient was headed for open abdominal surgery which included total gastrectomy with creation of esophagojejunostomy on Roux en Y limb. After surgery the patient had good recovery but later on developed ventral hernia. After 1 year, ventral hernia repair was being done using proline mesh. So the time of total treatment for this patient lasted more than 1 year.

### **Comparison of patients based on 20 variables and its effect on their remission**

The variables used to assess and compare the patients were 20 and are as follows:

1. Hospital Stay – after readmission
2. Onset of pain, fever, tachycardia, shortness of breath.
3. Postsurgical day of readmission
4. CRP- at readmission
5. CBC- at readmission
6. CT, X-ray – at readmission (positive/negative findings)
7. Time from readmission to reoperation.
8. Number of days in ICU
9. CRP & CBC dynamics
10. Fever dynamics



11. Bowel Movement dynamics
12. Number and places of drains
13. Dynamics of drain's output
14. Dynamics of anemia and hypoproteinemia
15. Dynamics of X-ray and CT scan findings .
16. Endoscopic findings if any .
17. Other issues that might have clinical significance or interest .
18. Age
19. Sex
20. BMI

**Table .1 Patients compared to the 7 of 20 variables**

Patient Number	Hospital Stay after readmission	Onset of Pain ,fever, SOB , tachycardia	Postsurgical day of readmission	CRP at readmission	CBC at readmission	CT/X ray findings at readmission	Time from readmission to re-operation
Pt. 1 (Male )	2 <sup>1/2</sup> months	Pain after 10 days of surgery, 38.5°C temperature , SOB , tachycardia (110 bpm)	10 <sup>th</sup> day	Elevated	Unremarkable	Ct Showed evidence of leakage	The reoperation was done when he was already in the hospital and had not been discharged
Pt.2 (Male)	2 <sup>1/2</sup> months	Pain after ~ 2 months of surgery, no fever , no SOB , mild tachycardia (80bpm)	59 <sup>th</sup> day	Not elevated as it was a chronic case	Unremarkable	No leakage seen on CT	2 days after readmission ,reoperation was performed
Pt.3 (Male)	1 week	Pain after 7 days post-surgery , 37.5°C, no SOB , Tachycardia (95bpm)	7 <sup>th</sup> day	Elevated	Unremarkable	Xray demonstrated presence of leakage so no further tests (CT) were done.	Patient was reoperated on the same day as the re-admission day
Pt.4 (Male)	3 days after which he was sent to turkey due to deteriorating condition.	Pain after 9 days post surgery , fever of 38.5°C, SOB , tachycardia (110bpm)	9 <sup>th</sup> day	Very Elevated (>200)	Unremarkable	Xray demonstrated presence of leakage so no further tests (CT) were done.	Patient was reoperated on the same day as the re-admission day
Pt.5 ( Male )	2 weeks	Pain after 2 weeks post surgery, fever of 37.5°C, No SOB , Tachycardia ( 98bpm)	14 <sup>th</sup> day	Moderately elevated (80-90)	Unremarkable	CT& Xray showed no evidence of leakage	No reoperation was performed , patient was managed pharmaco-logically
Pt.6 (Female)	3 months	Pain after 9 days post	9 <sup>th</sup> day	Very Elevated	Unremarkable	Ct showed evidence of	Patient was reoperated

)		surgery , fever of 39°C , SOB, Tachycardia (128bpm)				leakage	on the same day as the re-admission day
Pt.7 (female)	5 days	Pain after 10 days post surgery , fever of 37.4 °C , no SOB , tachycardia (90bpm)	10 <sup>th</sup> day	Very High (204)	ESR- 50	X ray findings were inconclusive , but CT showed evidence of leakage.	Patient was reoperated on the same day as the re-admission day

Patient Number	Hospital Stay after readmission	Onset of Pain ,fever, SOB , tachycardia	Postsurgical Day of readmission	CRP	CBC	CT/X ray findings at readmission	Time from readmission to re-operation
Pt. 8 (female)	3 months	Pain began on 6 <sup>th</sup> day post surgery 38.5°C, SOB (21) , Tachycardia ( 110bpm)	6 <sup>th</sup> day	Elevated (139)	ESR- 123	Ct showed evidence of leakage	The reoperation was done when she was already in the hospital and had not been discharged
Pt.9 (male)	2 months	Pain 14 days postsurgery, 38.2°C, SOB , Tachycardia ( 130bpm)	14 <sup>th</sup> day	Very high (500)	WBC count elevated (>16.14) ESR was elevated too	X ray was inconclusive , Ct couldn't be performed because the patient was morbidly obese (240kgs)	Patient was reoperated on the same day as the re-admission day
Pt.10	15 days	Pain after 18 days post surgery. Fever of 37.4°C, no SOB , Tachycardia ( 90bpm)	18 <sup>th</sup> day	67	WBC – normal ESR -28	X ray was inconclusive , CT showed presence of leakage	Patient was reoperated on the same day as the readmission day
Pt. 11	2 months and 6 days	Pain on 8 <sup>th</sup> day post surgery, fever of 37.1°C, no SOB , Tachycardia ( 90bpm)	8 <sup>th</sup> day	Very High (214)	WBC- 13 ESR-93	X ray and CT both showed no evidence of leakage	Patient was reoperated the next day of readmission

The Conclusions made upon comparison of the patients on the basis of 20 variables were

- 1) Intermediate leaks have better outcome than late leaks
- 2) Staple line leaks do not have any correlation with age, sex or BMI.
- 3) Feeding Jejunostomy has better control of nutritional status of the patient than parenteral nutrition.

- 4) Stenting has no evident efficacy in controlling gastric leakage.
- 5) Gastric Leak is not 100% preventable but can be cured with 95% efficacy if the admission is on time.
- 6) Admission On time , Re-laparoscopy, drainage, no touch technique & feeding jejunostomy was the treatment modality of choice that lead to the remission in most of the cases of Leakage.

### Conclusion

Statistically, without oversewing, there were 4% leaks (4 in 100 patients) and after enforcement of staple line with running sutures, there were only 0.63 % leaks (7 in 1100) So this indicates enforcement of staple line dramatically reduced the leakage rate.

Management of post-LSG leak is multimodal. Our hospital demonstrated that there is no one way of treating gastric leaks. Every patient requires a different approach & different treatment modality that fits their situation (location of leak, complications etc). The hospital experienced patients on extremes of both ends. On one extreme there was a patient who was treated solely on medications and on the other extreme a patient required total gastrectomy.

The end points of the study are as follows::

1. Staple line reinforcement with sutures dramatically reduces the leakage rate.
2. Early Leaks are probably related to surgical malpractice.
3. Intermediate leaks have better outcome than late leaks
4. Staple line leaks are not correlated to age, sex , BMI.
5. Feeding Jejunostomy has better control of nutritional status of the patient than parenteral nutrition.
6. Stenting has no evident efficacy in controlling gastric leakage.
7. Gastric Leak is not 100% preventable but can be cured with 95% efficacy if the admission is on time.
8. Admission On time, Re-laparoscopy, drainage, no touch technique & feeding jejunostomy is the standardized treatment for Leakage that should be adopted.

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Fig 1:

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