Laparo-Endoscopic Gastrostomy (LEG) Decompression: a Novel One-Time Method of Management of Gastric Leaks Following Sleeve Gastrectomy

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HOW I DO IT

Laparo-Endoscopic Gastrostomy (LEG) Decompression: a Novel One-Time Method of Management of Gastric Leaks Following Sleeve Gastrectomy

Pulimuttil James Zachariah[1] · **Wei-Jei Lee**[1] · **Kong-Han Ser**[1] · **Jung-Chien Chen**[1] · **Jun-Juin Tsou**[1]

Abstract
Background Leakage is the most feared and challenging complication following laparoscopic sleeve gastrectomy (LSG) as it can either be life-threatening or lead to major morbidity. Its management can be very complex. Endoscopic stents seem to be the mainstay of the current modality of treatment but are associated with a high rate of complications and also need supportive procedures for sepsis control and feeding. We aimed to approach this problem through a one-step intervention, achieving three objectives: a prolonged decompression of the gastric tube through a laparo-endoscopically placed gastrostomy, feeding jejunostomy and external drainage.
Methods Between 2014 January and March 2015, seven patients were managed for gastric leaks (post LSG) in our center by this novel approach. Their records were reviewed for details like prior operation, presence of comorbidities, if revisional surgery, day of presentation following surgery, intraoperative findings, post-op recovery, length of hospital stay, and time to heal. The results were tabulated and studied.
Results Three were post primary LSG. Four were following revisional surgeries. Six out of seven (85.7 %) healed without alternative intervention. One patient with a large rent was managed by fistulojejunostomy. The average length of stay was 20.7 days. All patients were on postoperative enteral feeding through jejunostomy. There were no gastrostomy-related complications or mortality.
Conclusions Laparo-endoscopic gastrostomy (LEG) decompression is a feasible, single-step, successful procedure in managing post LSG leaks and may be a viable alternative to avoid stent-related morbidity.

Keywords Sleeve gastrectomy · Complication · Leaks · Gastrostomy · Decompression

Introduction

Leakage is the most dreaded and challenging complication following laparoscopic sleeve gastrectomy (LSG) as it can either be life-threatening or lead to major morbidity [1]. Raised intraluminal pressures following LSG are suspected to be the cause of non-healing of the leak [2]. We report management of seven patients with gastric leaks following sleeve gastrectomy by a simple method of gastric decompression through a laparo-endoscopic gastrostomy (LEG) tube. Our aim was to approach this problem through a one-time procedure that include prolonged decompression of the gastric tube to reduce the intraluminal pressure, an independent route for enteral feeding via jejunostomy (laparoscopic), and a simultaneous laparoscopic "source control" of all septic foci with external drains.

Patients and Methods

Between January 2014 and March 2015, seven patients (one referred from outside) were managed for gastric leaks following LSG at Min-Sheng Hospital, Tauoyan, Taiwan. Patients' records were studied for details like prior operation, presence of comorbidities, revisional surgery, day of presentation following surgery, intraoperative findings, procedure done, operating time, post-op recovery, length of stay, and post-op nutrition. Outcomes were noted as additional procedures and

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healing time (time to removal of peritoneal drains, gastrostomy tube, and jejunostomy tube, respectively). Leaks were categorized according to the classification the International Sleeve Gastrectomy Expert Panel Consensus Statement [3].

Patients who presented with clinical symptoms suggestive of leak following LSG and confirmed by contrast study (either upper GI series or CT scan) were admitted from ER. After initial assessment and resuscitation of the patients, they were taken to the OT within 24 h. Under general anesthesia, simultaneous endoscopy and laparoscopy procedures were arranged.

Our LSG surgical technique is described in detail in an earlier publication [4]. Briefly, it is done over a 36F bougie with the transection starting from 4 cm proximal to the pylorus. Staple height was selected depending on the thickness of the stomach wall. We used 60 mm (either 4.4 or 4.1 mm at antrum and shifted usually after the second firing to 3.5 mm staplers) along the bougie to the esophagogastric junction. The staple line was then carefully invaginated with sero-serosal, non-absorbable sutures except the distal antral portion of the sleeve. The gastric tube was then fixed to the pre-pancreatic fascia (retroperitoneal layer) to prevent its kinking or volvulus.

Details of Laparo-Endoscopic Gastrostomy Drainage Technique in Post LSG Leaks

The patient was positioned in reverse Trendelenburg position. The operating surgeon stood between the thighs. The ports were placed through the prior positions used for the original operation—transumbilical-2 port technique, as per the protocol of the center [5]. Briefly, they were two peri-umbilical ports (15 and 12 mm), one epigastric 5 mm port for the liver retraction with a needle holder, and one 5 mm port on either side upper quadrants positioned after initial laparoscopy and internal landmarks. Using gentle adhesiolysis, a thorough inspection of the abdominal spaces and the overall pathology of the leak was assessed. The perforation was identified, sometimes, requiring an air-leak test. Purulent ascites or interloop and subphrenic abscess cavities were all detected and drained with suction.

An assistant passed a fiber-optic upper GI endoscope and cautiously advanced distally into the sleeve under laparo-endoscopic vision till the antrum. A tiny gastrotomy (3 mm) was made by the operating surgeon on the anterior healthy wall of the antrum at the pre-pyloric region (at least 3 cm away from the staple line) with the monopolar hook cautery (Fig. 1a) just to allow a polypectomy snare to pass through from inside the endoscope. A No.18 Fr. silastic (NG) tube was passed through a right upper quadrant port (which formed the exit site of the gastrostomy) and kept prior to this (Fig. 1b). The tip of this (NG) tube was grasped by the snare and pulled up into the sleeved stomach till just above the EG junction (later in the series, changed to below the EG junction) and left in situ (Fig. 1c, d) for gastric decompression and internal drainage of the perforation (which was usually at this site). After rechecking the alignment, patency, and position of the (NG) tube, the endoscope was withdrawn. The gastrostomy site was secured by a 3-0 silk "purse string" intracorporeal suture placed around the tube (no invagination of the gastrostomy tube or fixation to the transversalis fascia or muscle was done, unlike the traditional technique). This gastrostomy tube was connected to a vacuum bulb (200 ml) for drainage, and periodically emptied.

Approximation of the edges of perforation with fat pad covering was attempted (but may not be of additional benefit). A feeding jejunostomy was performed at the most proximal tension-free portion of the jejunum with a No. 14 Fr. silastic Foley's catheter, minimally inflated to prevent obstruction (Fig. 1e). The jejunostomy was secured with a purse string (3-0 silk) suture and anchored peritoneally to the transversalis fascia and muscle of the left upper quadrant without tension. Multiple drains (Jackson Pratt and rubber drains) were positioned adjacent to the perforation, subphrenic spaces, and pouch of Douglas, respectively (Fig. 1d).

Patients were managed postoperatively on IV fluids, broad spectrum IV antibiotics, and PPIs (TPN only if warranted). Early mobilization was encouraged. The patients were kept nil per orally in the recovery period. Most patients were started on jejunostomy feeds as soon as they had passed flatus (usually on the 3rd postoperative day). Upper GI series with water-soluble contrast were taken. The patients were discharged with all the drains and tubes and followed up in the outpatient department (see Table 1).

Results

Patient Characteristics

During the study period (January 2014 to March 2015), 405 cases of LSG were done in this center. Out of the seven patients presented with leak, one was referred from outside, two were following primary LSG, and four (57 %) were following revisional surgery (Table 1.). The total leak rate (including revisional bariatric surgeries) was 1.4 % and that following primary LSG was 0.49 %. It is to be noted that this center has a high rate of revisional surgeries including conversion from bypass to sleeve gastrectomy involving a gastro-gastric anastomosis [6]. The male female ratio was 3:4. The ages ranged from 22 to 45 years. The average preoperative BMI was 31.7 kg/m^2. Two patients (28 %) were diabetics. The earliest leak was 1 day following a post-op dilatation procedure and

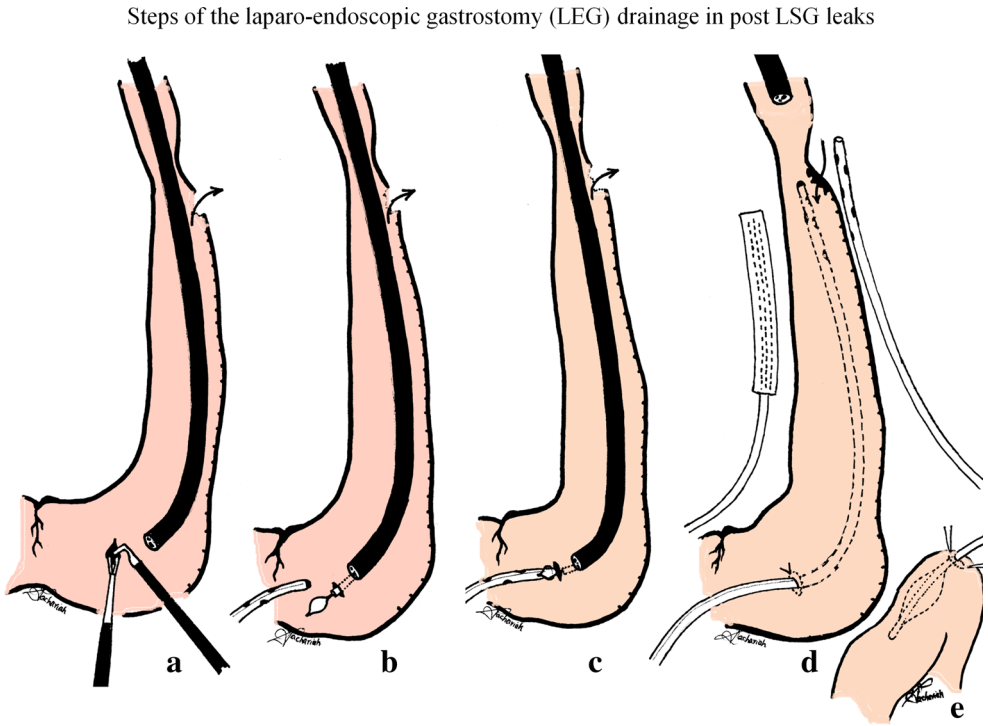

Fig. 1 **a–e**. Steps of the laparo-endoscopic gastrostomy (LEG) drainage in post LSG leaks

the latest was 64 days (mean 15.1 days). Four were acute, two early, and one late presentation [3].

Presentation

The commonest (57 %) site of the leak was high (at the upper part of the gastric tube nearer the EG junction) and the rest was at the mid gastric anastomotic area, the latter being in the group of converted sleeve gastrectomy procedures. There was only one patient with associated gastric stenosis which was following revisional surgery from RYGB to single-anastomosis duodenojejunal bypass and sleeve gastrectomy (SADJB+SG). This patient underwent balloon dilatation for the same and was found to have perforation the following day. All patients who presented more than 1 day later had abscesses in the subphrenic areas or interloop abscess. One had purulent ascites. All patients were managed by the procedure mentioned above.

Postoperative Course

The average time for this revision procedure that included LEG decompression, jejunostomy and peritoneal toilet, and placement of multiple drains was 148 min (95–250 min). Jejunostomy feeding was started after return of bowel sounds at a mean of 5.1 days (3–12 days). Two patients had left pleural effusion which was drained postoperatively. Average length of hospital stay was 20.7 days (12–33 days). All patients were managed as outpatients with nutritional support through jejunostomy.

Follow-up

Six (85.7 %) out of seven patients healed without reoperation for the leak. One patient (who presented with leak, 20 days following initial surgery) had recurrence of symptoms when given oral liquids after 8 weeks following LEG decompression. At exploration, there was a large rent of 4 cm, for which he underwent a successful Roux-en-Y (RNY) fistulojejunostomy. Endoscopic repositioning of the gastrostomy to position the tip just below the EG junction was done in four patients to facilitate better drainage after contrast study showed ongoing leak with improper tube position (it was either too low down in the sleeve or high in the lower esophagus). Thus, our initial technique to keep just above the EG junction was later changed to just below for better drainage. The peritoneal drains were first shortened and then removed when there was no discharge (1–6 weeks) either during hospital stay or on follow-up visits. The gastrostomy (LEG) tubes were removed after an average of 14.2 weeks (8–24 weeks) following trial feeding after clamping. Jejunostomy tubes were removed 2 weeks later when oral feeding was uneventful (Table 1). There was no gastrostomy-related morbidity or any mortality in this series.

Review and Discussion

This study provides a novel treatment method for the treatment of leak following LSG. This method was simple, cheaper, uncomplicated, and had a reliable outcome. We had

Table 1 Summary of the results of post LSG leak patients treated by LEG decompression

PT no.	Age	Sex	DM	Procedure	Revision surg.	Classification[a] (days)	Site of leak	Associated abscess	Dur. of opern. (min)	POP-jej feeds (started on)	Hosp stay (days)	Removal of drains (weeks)	G tube removal (weeks)	J tube removal (weeks)	Outcome
1	41	M	No	LSG	No	Early (8)	High leak	Large −2000 cc abscess cavity	135	3	18	15	18	20	Success
2	36	M	No	LSG	No	Early (20)	High leak	Sub phrenic abscess with large rent of 4 cm	145	4	33[b]	6	8	12	RYFJ repair
3	22	F	No	RYGB>LSG	Yes	Acute (7)	Gastro-gastric anast.	Sub hepatic abscess	110	5	15	5	8	9	Success
4	44	M	Yes	SADJB+SG	No	Late (64)	High leak	Purulent ascites	95	3	12	6	10	12	Success
5	34	F	No	RYGB>SADJB +SG	Yes	Acute (3)	Gastro-gastric anast.	Multiple interloop abscess	180	3	21	12	15	17	Success
6	33	F	No	SAGB>SG	Yes	Acute (3)	High leak	Lt subphrenic and Rt sub phrenic abscess	120	12	18	8	10	12	Success
7	45	F	Yes	RYGB>SADJB +SG	Yes	Acute (1)	Gastro-gastric anast.	Adhesions	250	6	28	20	24	26	Success
	36.4		DM (28 %)		Rev (57 %)	Acute (57 %)	High (57 %)	85.7 %	147.9	5.1	20.7	10.3	13.3	15.4	85.7 %

Abbreviations: *G tube* gastrostomy tube, *J tube* jejunostomy tube, *LSG* laparoscopic sleeve gastrectomy, *RYGB* Roux-en-Y gastric bypass, *SADJB+ SG* single-anastomosis duodenojejunal bypass+sleeve gastrectomy, *SAGB* single-anastomosis (mini) gastric bypass, *RYFJ* Roux-en-Y fistulojejunostomy

[a] Classification according to International Sleeve Gastrectomy Expert Panel Consensus Statement [3]

[b] This patient had postoperative bleeding from the leak site before discharge and needed to be controlled later by endoscopic clipping and blood transfusions etc., which prolonged the hospital stay

successful outcomes in six out of seven patients after we used this novel method.

There is nearly a twofold increase of intragastric pressures following sleeve gastrectomy [2]. However, in a randomized study, prophylactic decompression via nasogastric tube did not improve leak rates, raising the question if the increased pressure was a factor in its etiology [7]. The management of a post LSG leak still lacks a universally accepted algorithm. There is a current preference of therapeutic endoscopy procedures which has not still provided an attractive solution for this dreaded problem. It is so far unclear whether our goal be diversion (exclusion) or decompression in managing these gastric leaks.

In our center, we started performing LSG since 2007 and accumulated experience since then. We had previously adopted stenting as the protocol for post LSG leakage in the first 500 patients. However, this treatment method was associated with many complications (like migration, inadequate coverage, nausea, chest pain, difficult retrieval), in addition to the cost. It also had resulted in healing of only 50 % of the patients. The rest needed subsequent surgical procedures for treating the leakage. We stopped the use of stent after we innovated this method. The standardization of our LSG technique after the initial 500 cases led to lesser leaks (0.49 %) following primary LSG. The lower mean BMI noted in this present series is due to the revision cases who had already lost weight (conversion of bypass to sleeve for mostly severe anemia, malnutrition, marginal ulcer, or dumping) [6]. The site of leak in this category was seen more at the gastro-gastric anastomotic site, thereby decreasing the leaks at the EG junction to 57 % in this series and not higher, as seen in other studies.

Endoscopic stenting for gastric leaks has varying success rates from 50 to 100 % [8, 9]. There is presently no standardization about the type, the length and the diameter, or the number of the stents used. The objectives have been to divert the contents from the fistula site and to bypass the distal stenotic portion. Migration is seen from 33 to 63 % of these stents [10]. In some cases, it had migrated to the small bowel needing operative removal [11]. Other complications that have been reported include mucosal overgrowth resulting in retrieval problems, persistent vomiting, and decubitus ulcers [12]. Stenting alone did not solve the problem of source control in sepsis. In all patients (85 %) who presented to us after 1 day, there was associated severe abdominal sepsis with subphrenic, subhepatic, and interloop abscesses and in one case, purulent ascitis. These findings justify concurrent external drainage. In a recent study, 72 % of endoscopically stented patients needed an additional abdominal exploration for the same [13]. Stent-induced persistent vomiting with gastric leak can pose a nutritional challenge for patients on oral feeding. So, endoscopic stent placement as a potential management strategy needs special expertise, multiple sessions, has recognized complications with added costs, and still cannot be a stand-alone management.

Donatelle et al. [14] achieved closure in 20 out of 21 patients without metallic stents using the endoscopic drainage and enteral nutrition (EDEN) technique that included pigtail internal drainage, nasojejunal feeding, and OTSC (over the scope clips) to close the defects. All patients needed nasal tube feeding till oral feeds were well tolerated (more than 2 months on average). However, in our experience, NG tube feeding was not well tolerated by the patients and OTSC is not available in many countries. A nasal tube (either for feeding or a decompression) can be both be very limiting to patient's comfort and compliance, along with the risk of aspiration. A transabdominal route for both drainage and feeding allowed them to carry on with activities, especially when it was kept for an average of 2–3 months to allow healing of the leak.

T-tube gastrostomy through the perforation also has been described, for decompression and to convert it into a controlled fistula [15, 16]. However, the access to the perforation (and some instances even identification) at exploration is not always easy. Sakran et al. reported that in 6.8 % of cases, the perforation could not be located [17]. We could not locate in one patient (14.2 %). Any manipulations through an already ischemic EG region could lead to an "insult over injury," converting an acute fistula to a chronic non-healing fistula, requiring secondary surgical measures for closure later. In comparison, we place our gastrostomy through a healthy area of the distal antrum with intact vascularity closer to the anterior abdominal wall for a direct tract, with drainage of the entire gastric tube from the EG junction to the antrum.

Percutaneous transesophageal gastrostomy (PTEG) also has been successfully used in two patients in one study [18]. The principle here seems to be that of stenting and bypassing the EG junction for feeding and not for gastric decompression as it was aimed in our management.

The rationale of our procedure is as follows: about a liter of secretions from saliva and from the "sleeved" stomach collect in the lumen per day, which raises the pressures steeply in the narrow, less distensible sleeve. Once the perforation has occurred, the gastric contents are forced out into the peritoneal cavity. This constant pressure gradient across the perforation (the raised gastric luminal pressure on one side and the negative peritoneal space pressure on the other) could be a critical factor that leads to continuous "dribbling" of luminal fluid into the peritoneal cavity. The drainage that we employed provides decompression in the entire sleeve with some negative pressure that prevents this continuous dribbling. The good results reported with endoscopic vacuum therapy (EVT), used recently to treat upper gastrointestinal fistula, also seem to support a similar view [19]. Our aim was thus threefold, to approach this problem through a simple, prolonged (patient-compliant) decompression of the gastric tube, an independent route for enteral feeding via jejunostomy (laparoscopic), and a

simultaneous (laparoscopic) source control of all septic foci by external drains. All these would go along the standard surgical principles of fistula and sepsis management.

There are some limitations of this technique. Even though this method was used to treat successfully acute, early, and late leaks (that presented up to 64 days following surgery), it was not effective in closure of a large defect which resulted in considerable peritoneal collection. This patient required reoperation using RNY fistulojejunostomy. Secondly, repositioning of the LEG tube also may be required in cases where contrast studies indicate ongoing leak with improper position of this tube due to subsequent displacement.

In conclusion, decompression through a LEG tube along with separate feeding jejunostomy and external drainage seems to be a safe, cheaper, complete, one-step alternative option to stenting in managing most forms of post LSG leaks. In cases of uncertainty, where diagnostic laparoscopy is the ultimate diagnostic test [20], this approach can safely be incorporated if necessary, as a simultaneous therapeutic step, with almost no further requirement for operative interventions.

Conflict of Interest The authors declare that they have no competing interests.

Statement of Informed Consent This retrospective study did not require the participation of the subjects.

Human and Animal Rights No human or animal rights were violated in this study.

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