Nonoperative Management of Leaks After Laparoscopic Sleeve Gastrectomy With Endoscopic Stents in a Tertiary Referral Center

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ABSTRACT

Background: *Laparoscopic sleeve gastrectomy (LSG) is a frequently performed operation. Leaks are formidable complications; however, the optimal management of these leaks is controversial.*

Methods: *We retrospectively reviewed the medical records of 15 patients referred to our tertiary center between 2012 and 2016 with leaks after LSG.*

Results: *In 12 patients with whom ongoing leaks were identified, stents were inserted with the intent of definitive therapy. In addition to attempts at source control, percutaneous drainage was carried out for intraabdominal collection in 9 patients and pleural effusion in 4 patients. The length of stay in the intensive care unit was significantly shorter in patients referred earlier or in those without any intervention.*

Conclusion: *LSG leaks can be treated nonoperatively in well-organized centers under meticulously designed protocols, depending on the clinical condition of the patient.*

Keywords: *Laparoscopic sleeve gastrectomy, leak, stent*

INTRODUCTION

In accordance with the ever-increasing awareness of the benefits of bariatric surgery on obesity and its related health problems, laparoscopic sleeve gastrectomy (LSG) has become an emerging surgical procedure worldwide.[1] The benefit of LSG for both surgeons and patients arises from particular features such as the relatively shorter learning curve, shorter operating times, involvement of no intestinal procedures, and successful outcomes regarding weight loss compared with the most frequently performed bariatric procedure laparoscopic Roux-en-Y gastric bypass (LRYGBP).[2] However, similar to any other gastric resection procedure, LSG has some serious and potentially life-threatening complications, including leaks. The incidence of leaks from staple line disruption after LSG is reported as 0-7%.[3] Preventing leaks after LSG is the topic of many bariatric meetings, and cumulative knowledge on this seemingly easy but technically demanding operation has resulted in strong suggestions in order to reach the safest standards.[4,5] However, the management of these leaks is another matter of debate that shows greater diversity from conservative treatment to endoscopic procedures such as stenting, clipping, glue injection, endoluminal drainage with catheters, and percutaneous radiological or surgical drainage procedures with occasional major surgeries for attempts to repair, divert, or remove the leakage site.[4,6-11] In this paper, we report 15 patients suffering from leaks after LSG who were referred to and treated in our center.

MATERIALS AND METHODS

This study was approved by the Ege University Ethics Committee of Medical Research with the Decision Number: 19-5.27/5.

Between November 2012 and September 2016, 102 LSGs were carried out by the same surgical team in an academic university hospital that serves as a tertiary referral center. All the patients' body mass indexes (BMIs) were above 40 kg/m^2, and the indication for bariatric surgery

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for each patient was approved by a dedicated team consisting of a surgeon, an endocrinologist, a psychiatrist, a gastroenterologist, and a dietitian. No leaks were encountered within this cohort. During this period, 15 patients with leaks after LSG who underwent surgery elsewhere were referred to our center. All the operations were primary procedures, and none of them were revisions. The leaks were classified as acute in 3 patients (1-7 days), early in 9 (1-6 weeks) and late (6-12 weeks) in 2 according to previous consensus statements.[4] The patients were informed about the severity of the clinical situation and possible interventions, and written consent was obtained. All the patients were initially admitted to the level 2 surgical intensive care unit (ICU) for a detailed assessment, and the clinical situations upon admission were stratified with the Clavien–Dindo classification for surgical complications.[12] Then, the patients were transferred to the ward when clinically stable. The only patient requiring advanced respiratory support temporarily stayed in the level 3 ICU of the department of anesthesiology and reanimation. ICUs were classified according to the guidelines of The Intensive Care Society concerning the levels of critical care for adult patients.[13]

Following admission, with appropriate intravenous fluid therapy, wide-spectrum antibiotics were started empirically until the conclusion of cultures. Low-molecular-weight heparin (LMWH) prophylaxis was also given unless there was any uncertainty of bleeding. Oral and intravenous (IV) enhanced computerized tomography (CT) was immediately carried out in all patients, to detect the assumed leak from the staple line and secondary complications such as intraabdominal abscess, portal vein thrombosis (PVT), or pleural effusion. Intraabdominal collections and symptomatic pleural effusions were percutaneously drained by the interventional radiologist, and pleural catheters were connected to an underwater seal chest drainage system. In the 2 patients with thrombosis in the portal veins, LMWH dosages were scaled up to the therapeutic level.

In patients with detected staple line leaks, endoscopic stents were considered as first-line therapy. Stents were inserted by the interventional gastroenterologist in a standard endoscopy room combined with a C-arm image intensifier. In all patients with reported leaks on CT, the leak site was detected both endoscopically and fluoroscopically, and following the insertion of the stent, the sealing of the leak site was verified. The choice of covered stents was dependent on availability [Fully Covered Esophageal Fistula Stent, Micro-Tech (Nanjing) Co., Ltd, China: 24 mm diameter, 120 mm length or MEGA™ Esophageal stent, fully covered, Taewoong Medical Co., Seoul, Korea: 28 mm diameter, 230 mm length]. In patients with incomplete sealing due to the size of the stent, a second stent was inserted in a telescopic fashion to extend the line of insulation when a longer stent was not available. The decision to leave a nasojejunal (NJ) feeding tube was established in some cases in a subjective manner by the interventional gastroenterologist when he was concerned about immediate sealing. Oral feeding was started or delayed on an individual basis according to the certainty of sealing the leak radiologically while paying attention to the contents of the surgically or percutaneously placed catheters. These catheters were maintained until the daily amount of the drainage was less than 10 ml with contents divergent from the alimentary tract. Surgical management was reserved for patients whose clinical course might worsen.

Statistical Analysis

Analysis of data was performed by IBM SPSS Statistics for Windows, version 21.0 (Armonk, NY: IBM Corp.). Mann–Whitney U and Spearman rank correlation tests were used when appropriate. A *P* value of less than .05 was regarded as statistically significant for nonparametric analysis, and correlation was considered significant at the 0.01 level.

RESULTS

All the patients were successfully treated with conservative and minimally invasive techniques, and no surgical interventions were required according to the patients' medical conditions. The demographic data and clinical features of the patients with the management procedures before and after admission are presented in Table 1. The mean age of the group was 39.20 ± 14.21 years, and the mean BMI at the time of LSG was 44.86 ± 4.15 kg/m^2. Accompanying medical problems were recorded in 9 patients; however, no relationship was detected with the ICU or total length of stay (LOS) ($P = .081$ for ICU and $P = .231$ for total LOS). Technical difficulties encountered at the index operation were reported in only 2 patients. Six patients underwent reoperation before referral; however, recurrent/persistent leaks were observed in 5 patients, and 4 patients were still suffering from leaks during admission (in 1 of those 5 patients (patient 8), endoscopic glue injection had been performed after recurrent leakage before referral). In 3 patients, stent placement was attempted before referral; however, the leaks were not able to be controlled in any of the patients. Following oral and IV enhanced CT,

Table 1. The Demographic Data and Clinical Features of the Patients with the Management Procedures Before and After Admission

Patient	Age/ Sex	BMI at LSG	Accompanying Medical Problems	Any Reported Technical Problem During Index Surgery	Detection Day of Leak (Postoperative)	Any Intervention Before Referral	PO Day of Referral	Grade of Clavien-Dindo Classification on Referral	Medical Condition Requiring Intervention	Type of Management	ICU/Total LOS (Days) (Seperately for Each Admissions)
1	60/F	49	T2DM, HT	-	35	Re-operation (gastrostomy for decompression, external drainage of collection)	38 (3 days after 2nd operation)	3a (medical condition requires surgical, radiological or endoscopic intervention; not under general anesthesia)	Leakage of contrast agent and İntraabdominal collection on CT	1st: Endoscopic balloon dilation and stenting, antibiotherapy	1st: 4/20
									Gastrocutaneous fistula recurrence (no radiological leak)	2nd: NJ tube feeding	2nd: 1/17
2	30/F	44	-	-	15	-	17	3a	Leakage of contrast agent, İntraabdominal collection and pleural effusion on CT	Endoscopic stenting, percutaneous drainage of intraabdominal collection, Pleural catheter with underwater seal chest drainage system, antibiotherapy	2/21
										2nd: NJ tube feeding	
3	38/F	40	T2DM, HT	-	5	-	7	2 (medical condition requires pharmacological treatment, blood transfusion and/or total parenteral nutrition)	No radiological or endoscopic leakage, Recurrent fever following oral feeding, splenic ischemia, thrombosis at the right anterior branch of the portal vein, perfusion defect at the right hemiliver	NJ tube feeding, antibiotherapy, LMWH	1/25
4	44/F	44	T2DM, HT	-	4	-	4	3a	Leakage of contrast agent and İntraabdominal collection on CT	Endoscopic stenting, antibiotherapy (collection was not deemed suitable for percutaneous drainage, responded to stent and antibiotherapy), NJ tube feeding	2/36
5	51/F	52	OSAS	Convertion to open surgery and splenectomy due to iatrogenic injury	20	Chest tube insertion (left pleural effusion secondary to pneumonia and subdiaphragmatic abcess)	34	3a	Leakage of contrast agent and subdiaphragmatic abcess on CT, portal vein thrombosis	Endoscopic stenting, percutaneous drainage of abcess, LMWH, antibiotherapy	7/56

(*Continued*)

Table 1. The Demographic Data and Clinical Features of the Patients with the Management Procedures Before and After Admission (*Continued*)

Patient	Age/ Sex	BMI at LSG	Accompanying Medical Problems	Any Reported Technical Problem During Index Surgery	Detection Day of Leak (Postoperative)	Any Intervention Before Referral	PO Day of Referral	Grade of Clavien-Dindo Classification on Referral	Medical Condition Requiring Intervention	Type of Management	ICU/Total LOS (Days) (Seperately for Each Admissions)
6	31/F	41	OSAS	Incompetent stapling of the endoscopic lineer cartridge after cutting, convertion to open surgery	9	-	10	3a	Leakage of contrast agent and İntraabdominal collection on CT	Endoscopic stenting, percutaneous drainage of intraabdominal collection, antibiotherapy, NJ tube feeding	2/49
7	51/F	40	OSAS, HT	-	3	Re-operation (primary repair, external drainage)	25 (22 after 2nd operation)	4 (life threating complication requring ICU management)	Leakage of contrast agent and intraabdominal collection on CT, gastrocutaneous fistula, pulmonary insufficiency	Endoscopic stenting, percutaneous drainage of intraabdominal collection, antibiotherapy, mechanical ventilation, NJ tube feeding	13/122
8	56/F	41	OSAS, HT	-	6	1st: percutaneous drainage of subdiaphragmatic abcess 2nd: Re-operation (primary repair, external drainage 3rd: Endoscopic fibrin glue injection	49 (19 after 2nd operation)	2	Mental confusion secondary to metabolic derangement and prolonged hospitalisation, No radiological or endoscopic leak	NJ tube feeding, antibiotherapy	4/20
9	24/F	44	-	-	1	1st: Laparoscopic repair of the leak site on POD 1 2nd: Endoscopic stenting after recurrence of the leak 3rd: Re-operation for recurrent subdiaphragmatic abcess after stent removal	48 (2 after 2nd operation)	3a	Leakage of contrast agent and intraabdominal collection on CT, gastrocutaneous fistula, respiratory distress	Endoscopic re-stenting, percutaneous drainage of intraabdominal collection, antibiotherapy, NJ tube feeding	3/40
10	24/F	42	-	-	1	1st: Primary repair, external drainage 2nd: recurrent leak, convertion to Roux en Y gastric bypass (another hospital)	11	3a	Pleural effusion leading to respiratory distress. No radiological or endoscopic leak	Pleural catheter with underwater seal chest drainage system	1/7

(*Continued*)

Table 1. The Demographic Data and Clinical Features of the Patients with the Management Procedures Before and After Admission (*Continued*)

Patient	Age/ Sex	BMI at LSG	Accompanying Medical Problems	Any Reported Technical Problem During Index Surgery	Detection Day of Leak (Postoperative)	Any Intervention Before Referral	PO Day of Referral	Grade of Clavien-Dindo Classification on Referral	Medical Condition Requiring Intervention	Type of Management	ICU/Total LOS (Days) (Seperately for Each Admissions)
11	27/F	45	-	-	3	-	4	3a	Leakage of contrast agent and İntraabdominal collection on CT	Endoscopic stenting, percutaneous drainage of intraabdominal collection, antibiotherapy	2/34
12	51/F	51	T2DM, HT	-	3	Re-operation (primary repair, external drainage)	24 (21 after 2nd operation)	3a	Leakage of contrast agent and İntraabdominal collection on CT	Endoscopic stenting, percutaneous drainage of intraabdominal collection, antibiotherapy	25/62
13	57/F	47	HT	-	3	Endoscopic stenting, percutaneous drainage of intraabdominal collection, antibiotherapy	23	3a	Leakage of contrast agent and İntraabdominal collection on CT	Endoscopic re-stenting, percutaneous re-drainage of intraabdominal collection, antibiotherapy	5/18
14	22/M	51	-	-	1	Endoscopic stenting, percutaneous drainage of intraabdominal collection, antibiotherapy	23	3a	Leakage of contrast agent and İntraabdominal collection and pleural effusion on CT	Endoscopic re-stenting, percutaneous re-drainage of intraabdominal collections and pleural effusion, antibiotherapy	3/15
15	22/F	41	-	-	9	-	9	3a	Leakage of contrast agent and İntraabdominal collection and pleural effusion on CT	Endoscopic stenting, antibiotherapy (Intraabdominal collection was not deemed suitable for percutaneous drainage, responded to antibiotherapy) Pleural catheter with underwater seal chest drainage system	2/38

T2DM, Type 2 diabetes mellitus; HT, hypertension; OSAS, obstructive sleep apnea syndrome.

ongoing leaks were not detected in 3 patients. In 1 of the patients, recurrent episodes of high fever were revealed following oral feeding with no endoscopic or radiological leaks (patient 3), and the patient was considered as having a very small leak possibly from stapler holes, responding to management of nil by mouth policy and NJ tube feeding for 3 weeks. Two patients (8 and 10) who were referred after reoperations were admitted for postoperative care, and after verifying the absence of a leak, supportive therapies were implemented. In twelve patients with whom ongoing leaks were identified, stents were inserted with the intent of definitive therapy. In addition to attempts at source control, percutaneous drainages by the interventional radiologist were carried out for intraabdominal collection in 9 patients and pleural effusion in 4 patients.

The mean postoperative day (POD) of leak detection was 7.73 ± 9.34, and the mean POD of referral was 21.73 ± 15.0. The mean LOS in the ICU was 5.06 ± 6.29 days, and the total LOS was 37.53 ± 28.14 days. When comparing the patients with any surgical, radiological, or endoscopic treatment attempts after leakages, patients without any intervention before referral were significantly associated with shorter stays in the ICU (P=.010); however, the total LOS was similar in both groups (P=.637) (Table 2). The LOS in the ICU also showed a significant relationship with the time until referral (P=.003, correlation coefficient=0.715), whereas the total LOS did not (P=.819, correlation coefficient=0.064).

Outcomes of Endoscopic Stent Treatment

Thirty-four endoscopies were carried out for 12 patients and 24 stents were used. The most frequent complication was migration, which was observed in 7 patients (58%). Repeated endoscopies were occasionally performed to correct the position of the stents. Tolerance problems were observed in 4 patients (33%) who were treated with analgesics and anti-emetics. In patient 15, a perforation was encountered at the proximal esophagus during stent insertion. This perforation could not be controlled with hemoclips, and another stent was placed. The details of the stent treatments are presented in Table 3.

In 5 patients, even fluoroscopic images revealed no abnormalities, the contents of the drains or catheters were still associated with leakages. In these patients, a second stent was placed telescopically to extend the line of insulation through the duodenum (Figure 1a and b).

The mean time interval until stent removal was 63.25 ± 33.17 days. Patient 1 was the only patient with fistula recurrence after stent removal with no radiological leakage; nevertheless, the fistula disappeared after 11 days of post-pyloric feeding via the NJ tube.

DISCUSSION

Since it was introduced in the early 2000s as the initial step of a 2-stage operation, LSG rapidly became a popular stand-alone bariatric procedure that is currently performed in almost all surgical clinics with laparoscopic equipment throughout the world.[5,14] It is perceived as a relatively easy and safe operation; however, recent reports reveal that LSG has comparable mortality rates to LRYGBP, which is regarded as an advanced laparoscopic procedure.[15,16] LSG creates the longest transection line among the gastrointestinal operations, and leaks from this stapled line are the most serious complication of the procedure. The vast majority of leaks occur at the proximal site of the stapler line around the angle of His. Technical errors such as esophageal stapling, thermal injury, or inaccurate utilization of stapler cartridges may cause this complication, whereas theories considering intraoperative hemodynamic instability, vascular deficiencies, or manometric alterations are investigated to elucidate the underlying mechanism.[17-20] The reason for the leak is of utmost importance because it will directly affect the selection of the type and the outcomes of management; however, it is not always possible to determine in practice. However, leaks detected in the first 24-48 h are presumed to arise from technical/mechanical errors, and allowing a chance for repair is recommended.[21,22] Surgical

Table 2. The Relationship Between the Patients' Referral Times and Interventions Before Referral With Length of Intensive Care (ICU) and Total Hospital Stays

LOS (Mean ± SD Days)	ICU	Total
Patients without any intervention before referral	1.83 ± 0.40	33.83 ± 9.94
Patients with any surgical, radiological, or endoscopic treatment attempt before referral	7.22 ± 7.49	40.0 ± 36.16
P value	.010*	.637

*Statistically significant.

Table 3. Data Related to Endoscopic Stent Treatment and Outcomes

Patient	Endoscopic Localisation of the Leak (± Other Findings)	Type of Stent(s)	Number of Stents Inserted	Complications Related to the Stents	# Repeated Endoscopies	Duration Until Stent Removal (Days)	Any Event After Stent Removal	Management of the New Event
1	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd	1	Chest pain, nausea, vomiting	2	44	Readmission with gastrocutaneous fistula recurrence (no radiological leak)	NJ tube insertion for feeding, fistula disapperaed after 11 days
2	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd	1	Nausea, vomiting	2	26	-	-
4	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd	2	Migration	3/Endoscopic re-stenting (second stent placed telescopically to extend the line of insulation)	65	-	-
5	Proximal stomach (with stenosis at incisura angularis)	Micro-Tech (Nanjing) Co., Ltd	1	-	2	52	-	-
6	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd	4	Migration, pseudopolipoid tissue hyperplasia	6/Endoscopic re-stenting (second stent placed telescopically to extend the line of insulation)	58	-	-
7	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd & Taewoong Medical Co., Seoul, Korea	3	Migration	4/Endoscopic re-stenting (second stent placed telescopically to extend the line of insulation), then exchange with longer stent	153	-	-
9	1—Proximal stomach 2—Distal stapler line	Taewoong Medical Co., Seoul, Korea	2	Migration, nausea	3/Endoscopic re-stenting (second stent placed telescopically to extend the line of insulation)	72	Before admission—Recurrence of the leak after stent removal and possible erosion on distal stapler line	

(*Continued*)

Table 3. Data Related to Endoscopic Stent Treatment and Outcomes (*Continued*)

Patient	Endoscopic Localisation of the Leak (± Other Findings)	Type of Stent(s)	Number of Stents Inserted	Complications Related to the Stents	# Repeated Endoscopies	Duration Until Stent Removal (Days)	Any Event After Stent Removal	Management of the New Event
11	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd	2	Migration, vacuum like intrusion of antrum through the distal end of the stent	3	48	-	-
12	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd	1	Migration	3	96	-	-
13	Proximal stomach	Taewoong Medical Co., Seoul, Korea	2	-	-	45		
14	Proximal stomach	Taewoong Medical Co., Seoul, Korea	2	Migration	3	44		
15	Proximal stomach	Micro-Tech (Nanjing) Co., Ltd	3	İatrogenic perforation at proximal esophagus, clips failed, a second stent inserted to the perforation site, voice disorder, nausea and swallowing problems due to the proximal stent	3/Endoscopic re-stenting (the third stent placed telescopically through the gastric stent to extend the line of insulation)	Proximal stent 13 days Distal stents removed at day 56	Limited healing of the perforation site at proximal esophagus	Clipping

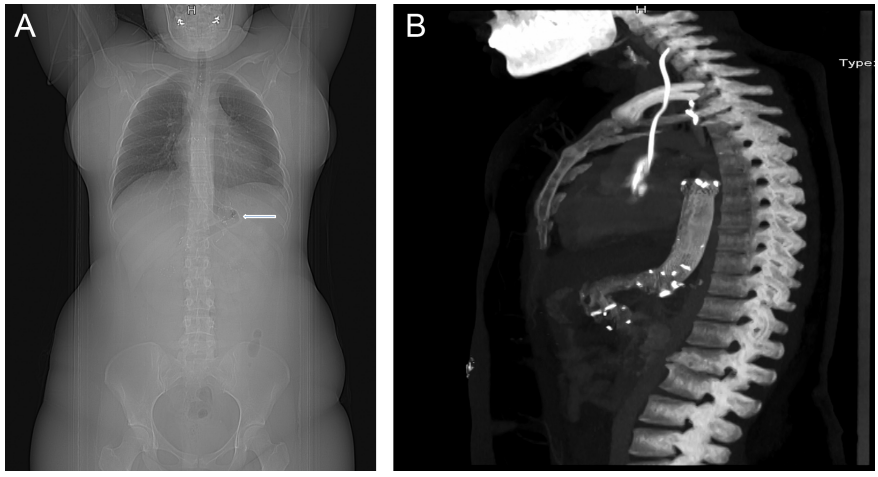

Figure 1. (a) X-ray view of the 2 stents placed in telescopic fashion, arrow indicates the junction of 2 stents. (b) Stents in CT images, sagittal reconstruction.

repair of leaks detected after this time interval is generally considered to have a low chance of success, and urgent re-laparoscopy in order to wash out and drain the leak site may be the only option if the patient's condition mandates. In our cohort, 6 of the 15 patients underwent reoperation before referral. Primary repair was attempted in 5 patients whose leaks were detected in the first 72 h, but failure occurred in all patients. Only 2 patients' leaks were discontinued after a third intervention: endoscopic glue injection in 1 patient and conversion to LRYGBP in another despite it not being recommended except for chronic fistulas.[4] Our policy that seems to avoid surgical correction was primarily based on the days of referral, which could be called late for successful outcomes and more importantly allowed by the patients' medical conditions. In all patients, we identified a chance of minimally invasive intervention and could avoid mandatory surgery. Removal of the leakage contents by percutaneous drainage and source control by endoscopic stents provided an immediate clinical response. The reason for our tendency toward stent therapy among the other endoscopic techniques was our center's previous experience in treating malignant strictures, anastomotic complications, or perforations in selected gastrointestinal cases.

In 5 patients in our series, although the leaks disappeared radiologically after stent insertion, drain or catheter contents were still associated with leaks. The stents used in these cases were primarily designed for esophageal fistulas, and their proximal ends were placed at the distal esophagus. However, when the distal end of the stent does not reach the duodenum, gastric contents might pour back around the stent through the proximal leak site. This opinion is basically attributed to the theoretically different compliance of the gastric wall–even in a sleeve shape–when compared with the esophagus. This problem currently seems to be overcome with longer stents, which we used in 4 patients. These stents may reach the duodenum and bypass the whole stomach; however, when they are not available more than 1 esophageal stent may be used for this purpose, as we did in 5 patients.

The safety and efficacy of covered self-expandable metallic stents have been suggested in various studies for the treatment of complications following foregut surgery, particularly bariatric surgery.[23,24] The potential complications related to these stents can be minor as tolerance problems, including pain, nausea or reflux, or major as perforation, bleeding, or migration.[25] The necessity for repeat endoscopies is frequent. The rate of migration, which was the most frequent complication in our series, was 58% and showed consistency with previous reports.[26] The most serious complication related to stent insertion was perforation at the proximal esophagus in patient 15, in whom pushing the guidewire forward through the duodenum presented difficulty, and during the manipulation, the proximal site of the wire took the form of a loop and injured the esophageal wall. The edges of the perforation could not be successfully closed with the hemoclips. Urgent surgery was discussed; however, this patient was referred at POD 9, and surgery was not considered for her primary pathology initially. Therefore, placing a second stent was decided for this proximal site while accepting the risks associated with this location. She experienced voice, swallowing, and tolerance problems as expected, but after 2 weeks, the proximal stent was removed, and

clips were successfully placed. The perforation site healed uneventfully.

In our series, the LOS in the ICU was significantly associated with 2 parameters associated with the period before referral. The patients referred earlier had significantly shorter stays in the ICU. Shorter ICU stays were also observed in the patients referred without any intervention. These 2 findings may be interpreted by the fact that these patients had better clinical conditions at the time of admission. Worldwide, increasing experience with LSG will decrease the percentage of complications; however, an increasing number of operations may keep the actual number high. Therefore, as recommended for laparoscopic cholecystectomy, which is another frequently and commonly performed procedure, early referral to a tertiary care center experienced in surgical complications featuring an interventional gastroenterologist and radiologist may lead to successful nonoperative treatment outcomes.[27]

PVT after complicated LSG seems to be an underestimated and underemphasized clinical entity. The incidence of 13% in our series was higher than the reported rates of 0.4% in a wide LSG series.[28] Nevertheless, the real incidence of PVT after LSG leakages is vague in terms of the underlying mechanism as well. The possible causes suggested to explain this issue may include patient or surgery-related factors; however, particularly in obese patients with leaks, increased procoagulant activity should be considered.[28-30]

The limitations of the current study are the diversities of the patients in the study group regarding the prior interventions before referral, the retrospective manner, and the relatively low number of patients for a powerful conclusion. Hence, we preferred to focus on our outcomes of stent treatment instead of suggesting an algorithm. However, most of the reports on this issue have the same features, and more accurate suggestions for the management of LSG leaks may be achieved by gathering this knowledge. Recent reports suggesting management algorithms concerning LSG leaks may lead these endeavors.[31,32]

In conclusion, in the current article, we wanted to reveal how heterogenous the management of a potentially lethal complication can be among surgeons after a frequently performed procedure. However, this management can be more effectively performed in well-organized centers under meticulously designed protocols.

Ethics Committee Approval: This study was approved by the Ege University Ethics Committee of Medical Research (No: 19-5.27/5).

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