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Gastroesophageal Stents for the Management of Post Sleeve Gastrectomy Leakage: Interventional Radiology Experience

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Abstract

Objective The aim of this study was to assess the efficacy and safety of retrievable, self-expandable gastroesophageal stents to manage gastric leaks post sleeve gastrectomy by interventional radiology (IR).

Methods This is a retrospective study of patients with gastric leaks post sleeve gastrectomy who were managed with gastroesophageal stent placement. The diameters of the stents ranged from 23 to 30 mm and the lengths 12.5 to 24 cm.

Results Thirty-one patients (mean age, 32.4 ± 7.97 years) were included in the study, and 46 stents were placed. The total average stenting time was 59.1 ± 35.5 days. Leakage resolved in 93.5% of the patients. Thirty-eight (82.6%) of the stents were retrieved by IR, and the remaining stents were retrieved under endoscopic visualization. Stricture occurred as a complication in four patients: three of which were treated with stenting (one by IR and two by endoscopy) and one required esophagoplasty. Six patients experienced stent migration, three of which underwent stent adjustment, while the remaining three underwent stent reinsertion

Conclusion Gastroesophageal stent placement by IR for gastric leaks post sleeve gastrectomy is safe and effective in our study.

Keywords
- sleeve gastrectomy leakage
- gastric sleeve leak
- gastroesophageal stent
- minimally invasive
- interventional radiology

Introduction

Sleeve gastrectomy is gaining popularity among bariatric surgeons due to its efficacy in inducing weight loss as well as its technical simplicity and lower rate of complications compared with other surgical procedures. Currently, sleeve gastrectomy is the most common bariatric surgery globally.[1–3] Nevertheless, gastric leaks remain a challenging concern due to difficulties in their management and associated patient comorbidities.[4–6] Several surgical, endoscopic, and

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radiological techniques have been utilized to achieve effective sealing of gastric leaks.[7–11] The incidence of gastric leaks post bariatric surgeries ranges between 0.1 and 5.6%, and pathogenesis of these leakages is triggered by ischemic or mechanical causes. Several risk factors may predispose postoperative leaks including previous bariatric surgery, body mass index, diabetes, hypertension, and others.[8]

Unlike the endoscopic approach to treat gastric leaks post sleeve gastrectomy, there is scant literature on the treatment of gastric leaks using gastroesophageal stents by interventional radiology (IR). A study by Guzaiz et al[7] investigated using gastroesophageal stents by IR in 12 patients with post gastric sleeve leakage and demonstrated leak healing in all patients. Furthermore, a study from Spain by Serra et al[12] included six patients with gastric leaks who were treated with stents by IR. The intervention was successful in five patients.

The aim of this study is to evaluate the effectiveness and safety of retrievable, self-expandable covered stents by IR to treat gastric leaks post sleeve gastrectomy.

Methods

Study Design and Setting

In this retrospective study, all patients who underwent sleeve gastrectomy complicated by leakage and managed with gastroesophageal stenting by IR between July 2014 and December 2019 were included. Leakage was diagnosed by either computed tomography (CT) scan or by an upper gastrointestinal study. The Institutional Review Board approved the study and waived the need for informed consent.

Patients

Patients who were treated by surgical reintervention and patients with missing data and/or follow-up were excluded from the study; only patients with the Niti-S^{T} esophageal stent (Taewoong Medical, Gyeonggi-Do, South Korea) as their initial stent or for restenting after failure of other stent types were included in this study to improve the homogeneity of the cohort characteristics. This particular make of stent was selected because it is the most frequently used type of stent in our unit. Age, sex, date of stent implantation, date of stent retrieval, type of stent, and the stent diameter and length were obtained from patients' electronic chart. The clinical and imaging data obtained for each patient during the follow-up were also included in this study.

Procedure Details

Stent placement and retrieval were completed under general anesthesia. The presence of the leakage was detected using a water-soluble contrast injection in the distal esophagus (►**Fig. 1**). The gastroesophageal stent was introduced via transoral approach using a super stiff guidewire without a sheath after cannulating the duodenum (►**Fig. 2**). Occasional oral and nasal suctioning were done to lower the risk of aspiration. Nutritional intake either through a nasojejunal tube or via total parenteral nutrition and solid oral intake was resumed as tolerated. Stent retrieval by IR was achieved

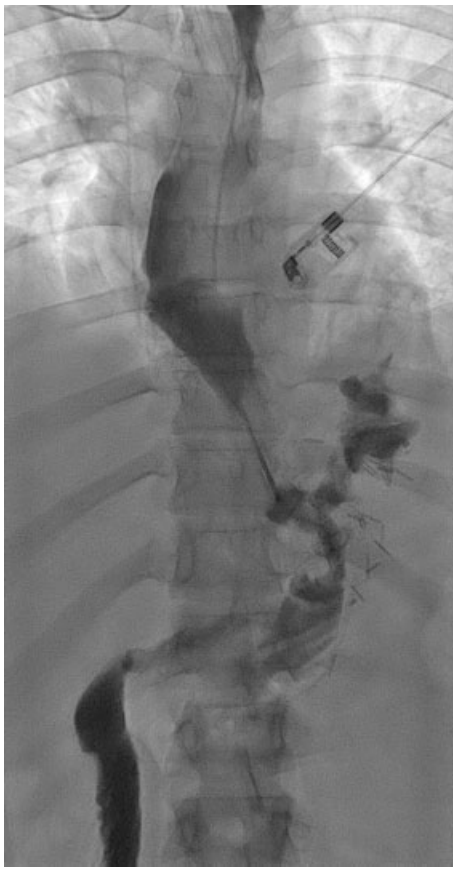

Fig. 1 Intraprocedural fluoroscopy showing staple line leak.

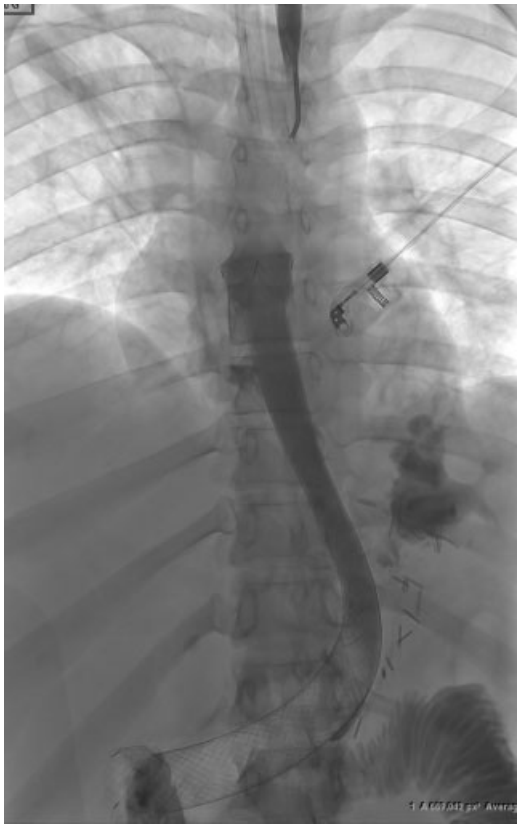

Fig. 2 Fully covered gastroesophageal stent deployed successfully.

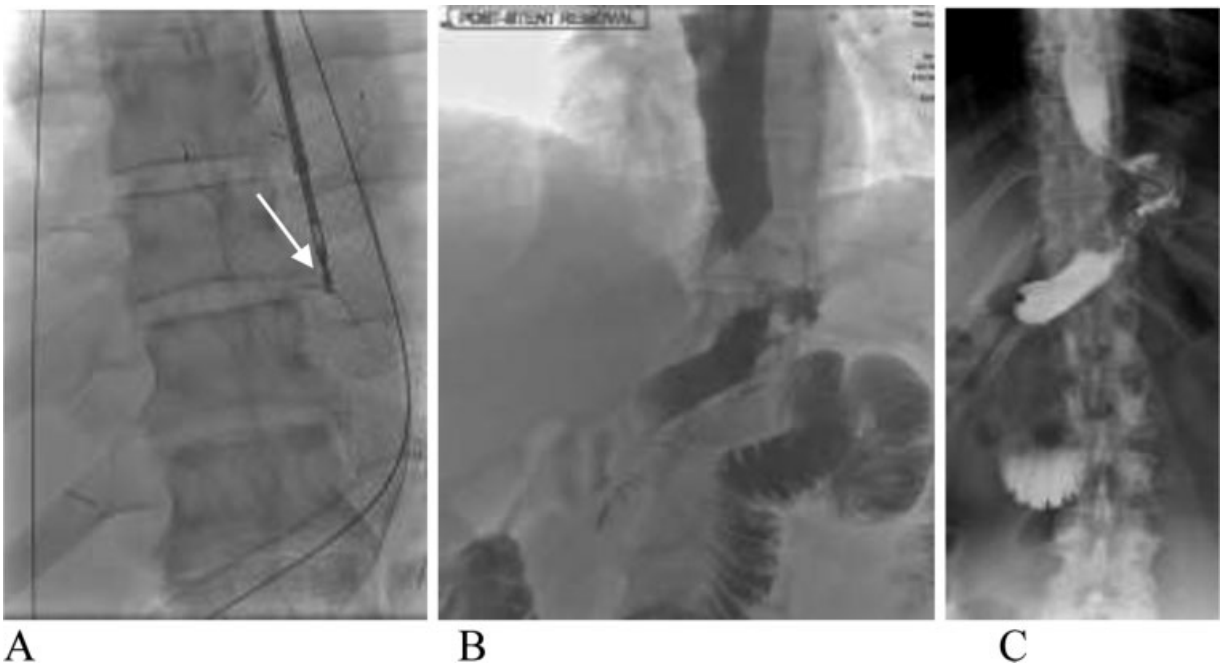

Fig. 3 Intraprocedural fluoroscopy image showing (**A**) forceps (arrow) capturing the stent. (**B**) Intraprocedural post stent removal image showing no residual leak. (**C**) Follow-up upper gastrointestinal study after 4 months showing no leak.

by capturing and removing the stent using the Raptor grasping device (US endoscopy, Mentor, Ohio, United States) via an oral approach (►**Fig. 3**). Post retrieval, an upper gastrointestinal study, and/or CT scan were done to identify persistent leaks. Clinical success was defined as no leak in the final outcome.

Statistical Analysis

The statistical analysis was performed using R version 3.6.2. (RStudio, Inc., Boston, Massachusetts, United States). The continuous variables were summarized using mean ± standard deviation or median (interquartile range), as appropriate, and the categorical variables were summarized using counts and percentages. Binary logistic regression was used to assess the factors associated with stent migration. Hypothesis testing was performed at a 5% level of significance.

Results

Thirty-one patients (16 males and 15 females) with a mean age of 32.4 ± 7.97 years were included in this study. A total of six patients were excluded from this study. The majority (89.17%; $n = 41$) of the stents used were Niti-S. Four (8.7%) Hanarostents (M.I.Tech, Gyeonggi-Do, Korea) and one (2.17%) WallFlex stent (Boston Scientific, Natick, Massachusetts, United States) were also used. The diameters of the stents ranged from 23 mm to 30 mm, and the lengths were between 12.5 cm and 24 cm. The average time of each individual stent placement to retrieval was 38.9 ± 21 days. The average total stenting time (from first stent placed to last stent removed for each patient) was 59.1 ± 35.5 days.

Reintervention was required in 14 (45.2%) of the patients. The average time to reintervention was 24.2 ± 17.6 days (►**Table 1**). The main reasons for reintervention included persistent leak ($n = 7$, 22.5%), stent migration ($n = 6$, 19.35%), and stricture ($n = 1$, 3.22%). Stent adjustment was required in three patients due to migration, and the remaining three patients with stent migration underwent stent reinsertion. Leak was controlled in 29 (93.5%) of the patients. Leak persisted in two patients who underwent reintervention by endoscopy. Eight (17.4%) stent retrieval procedures

Table 1 Summary of reinterventions used in the included patients

Reintervention:		
No	17 (54.8%)	
Yes	14 (45.2%)	
Time to reintervention (days)	24.2 ± 17.6	
Stent reinsertion:		
No	21 (67.7%)	
Yes	10 (32.3%)	
Reason for reintervention:		14
Leak	7 (22.5%)	
Migration	6 (19.35%)	
Stricture	1 (3.22%)	
Removal mechanism:		46
Endoscopy	8 (17.4%)	
IR	38 (82.6%)	
Final outcome:		31
Persistent leak	2 (6.45%)	
No leak	29 (93.55%)	

Abbreviation: IR, interventional radiology.

were performed using endoscopic visualization. The remaining stents (82.6%, $n = 38$) were removed by IR. One patient with stricture required esophagoplasty, and two patients with stricture underwent restenting by endoscopy.

Discussion

This retrospective study explored the effectiveness and complications of using retrievable self-expandable stents to manage gastric leak post sleeve gastrectomy by IR among 31 patients in a tertiary hospital in Saudi Arabia. The success rate (defined as no leak in the final outcome) was 93.55%, which is comparable to the success rate of the endoscopic management reported in a meta-analysis conducted by Puli et al,[8] which included 67 patients in seven studies with a success rate of 87.7%. In addition, a study from Kuwait on 17 patients showed a success rate of 76% using an endoscopic approach, and the median duration of the stenting time was 42 days.[13] In our study, the average time of each individual stent placement was 38.9 ± 21 days and the average total stenting time (from first stent placed to last stent removed) was 59.1 ± 35.5 days.

About 55% of our patients underwent stenting only once and did not require any reintervention (including new stent insertion, stent adjustment, and collection drainage). The causes of reinterventions among the patients in this study were persistent leak (50%), stent migration (43%), and stricture (7%). Similarly, in the study by Klimczak et al,[14] which included 14 patients and used Niti-S (mega) stents, restenting was required in 46% of the patients. Moreover, a study in Saudi Arabia showed that 82.8% of the patients underwent stenting only once and the patients who received partially covered self-expandable metal stents were significantly more likely to undergo stenting only once compared with those who received fully covered stents.[15]

Four (13%) patients in this study had stricture as a complication. Three were treated by stenting (one managed by IR and two by endoscopy), and one patient underwent esophagoplasty. Similarly, in Murino et al's study, 14% of the patients had stricture as a complication, 5% had hemorrhage, and 2% had perforation.[16] A systematic review by Hughes et al[17] included 26 articles on different treatment methods of post sleeve gastrectomy leakage, and it showed 62% success rate in patients who initially treated endoscopically, 76% in patient who were managed surgically, and 82% in patients managed conservatively.

The limitations of this study include its retrospective single-center design, multiple operators, and variable follow-up. Nevertheless, this study demonstrated the safety and effectiveness of the IR approach to treat gastric leaks post sleeve gastrectomy. More studies investigating the IR approach to treat gastric leaks are warranted to determine the effectiveness and complications of the IR method.

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Conflict of Interest
The authors declare no conflict of interest.

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