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ENDOLUMINAL SURGERY

Sleeve gastrectomy revision by endoluminal sleeve plication gastroplasty: a small pilot case series

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Abstract
Background The necessity for reoperation due to insufficient weight loss after bariatric surgery has led to a novel endoluminal plication of the gastric sleeve using a endoscopic suturing device. Advances in endoluminal endoscopy and other minimally invasive bariatric surgeries have inspired innovative techniques and have produced reliable suturing tools for gastric volume reduction.
Methods Retrospective pilot case series of 5 patients with an enlarged gastric sleeve.
Results The data show a sustained weight loss for all patients ranging from 19 to 36 lbs at 1 year, with the greatest average weight loss (27 lbs) observed at 6 months. At 1 year post-op, the mean body mass index was 33 kg/m^2. Four of the patients were considered successful, with a excess weight loss (EWL) sustained at 1 year post-procedure, ranging from 21 to 61% with a mean of 38%. One patient experienced a EWL of only 13%, which was attributed to failed lifestyle modification. The mean EWL of the series is 33%. The percent total weight loss (%WL) ranged from 6.7 to 17.2%.
Conclusions The endoluminal approach with an endoscopic suturing device for sleeve revision by plication is showing early promising results and expands the management of weight gain following laparoscopic sleeve gastrectomy. This simple approach may offer a significant option for these patients as an interventional strategy in the early phases of weight regain, and prior to reaching a BMI of 40 kg/m^2, such as the traditional surgical approach.

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Keywords Endoluminal · Endoscopic · Sleeve gastrectomy · Sleeve revision · Endoscopic plication · Weight gain

Laparoscopic sleeve gastrectomy (LSG) is considered a safe and effective primary treatment modality for morbid obesity [1–3]. LSG results in excess weight loss (EWL) between 52 and 70% at 5 years, as well as statistically significant improvements in pre-existing co-morbid conditions such as hypertension, diabetes mellitus, and dyslipidemia [3–6]. While EWL after LSG is generally >50% after 5 years of follow-up, treatment failures or renewed weight gain can result in only moderate weight loss for some patients [2, 3]. The necessity for reoperation due to insufficient weight loss after bariatric surgery has been reported in 13–20% of patients, either by weight regain or failure to achieve weight loss [6, 7].

Many revisional surgical options have been described, including, but not limited to, LSG conversion to Roux-en-Y gastric bypass (RYGB), duodenal switch (DS), as well as re-sleeve and gastric plication of the gastric sleeve. Due to the high rate of morbidity associated with laparoscopic and open revisional surgery, ranging from 5 to 20% complication rates, less invasive endoscopic procedures may offer an attractive alternative [8, 9].

Sleeve gastroplasty reduces the gastric volume of the stomach by 75–80%. Weight regain appears to be common with LSG after 3 years [2]. When the patient begins trending toward consistent weight regain, sleeve dilatation can be a contributing factor which could benefit from additional weight loss procedures, such as a gastric sleeve volume reduction using endoluminal plication.

Advances in endoluminal endoscopy and other minimally invasive bariatric surgeries have inspired innovative

techniques and have produced reliable suturing tools for gastric volume reduction [10]. The initial data on gastric plication, showed its effectiveness for short- and medium-term weight loss, with low complication and reoperation rates, as well as the EWL being comparable to LSG [11]. Although the initial weight loss results are not as dramatic as a traditional RYGB, these endoscopic procedures have proven worthy of further exploration as they have resulted in some weight loss with minimal risk to the patient.

Conventional surgical intervention takes place only when the BMI reaches 40 kg/m^2. We report the use of an endoscopic approach of an earlier intervention to create endoluminal plications with an endoscopic suturing device in dilated gastric sleeves to re-initiate weight loss following a primary LSG procedure.

Materials and methods

Appropriate IRB was obtained for this study. Informed consent was not needed as it was a retrospective study.

Pre-procedure evaluation

All patients underwent an upper gastrointestinal (UGI) series to assess the sleeve anatomy and to specifically assess for the presence of a retained fundus or an enlarged gastric sleeve. In addition, patients were evaluated by a bariatric dietitian to identify dietary causes of weight regain, ranging from poor dietary adherence (e.g., grazing and frequent snacking), and/or the ability to ingest large meals. An obvious presence of a significant psychological disturbance warranted a psychiatric evaluation and intervention. After instituting behavioral and dietary modifications and interventions, and if an enlarged sleeve was determined to be contributing to the patient's weight regain, then an endoscopic plication of the sleeve was offered to the patient.

Procedure

Under general anesthesia, and with the patient in a supine position, an endoscopy was performed using a single-channel endoscope (GIF180, Olympus America, Center Valley PA) with placement of an esophageal length overtube. The anatomy of the sleeve is reviewed with targeted identification of the distal aspect of the gastric sleeve. Subsequently, the gastric mucosa along the anterior and posterior gastric sleeve walls was coagulated using argon plasma coagulation (APC) to provide a visual mucosal guide to suture placement along the length of the sleeve. The APC coagulation helped delineate the sleeve anatomy. A two-channel endoscope (GIF-2T160, Olympus America, Center Valley PA) with a distal suturing device (Over-Stitch™ Endoscopic Suturing System, Apollo Endosurgery, Austin TX), attached to a second processor and light source, is then passed through the overtube and into the dilated sleeve, allowing for direct visualization. Full-thickness stitches were placed in figure of eight configurations with each suture creating plications of apposing gastric walls within the gastric sleeve starting distally at the level of the incisura and moving proximally, just below the gastroesophageal junction. The number of sutures placed varies among patients, but would include at least 6–8 sutures, corresponding to 6–8 plications. If mucosal bleeding from stitch placement was obscuring the suturing process, it was washed and cleared by conveniently switching to the standard diagnostic scope that was maintained at the ready via a second processor and light source.

Post-operative care

Patients were admitted overnight for observation with UGI performed the following day prior to starting a liquid diet. Lifestyle modification was resumed. Patients were advanced to a regular diet over a 4-week period. Monthly post-operative visits were recommended to the patients.

Results

Five patients (4 men; 1 woman) underwent endoscopic endoluminal plication of the original sleeve. Patient demographic, baseline characteristics and reported weight loss are presented in Table 1. The mean age and body mass

Table 1 Patient data

Patient	Age	Initial BMI	Weight (lbs)						%EWL	%WL	BMI change
			Initial	1 month	3 month	6 month	1 year	Final BMI			
Male 1	63	35.1	252	234	233	230	232	32.4	27	7.9	2.7
Male 2	62	39.3	290	265	262	264	265	35.9	21	8.6	3.4
Female 1	65	32.4	189	172.5	167	162	165	28.3	41	12.7	4.1
Male 3	48	48.2	285	272	270	265	266	44.9	13	6.7	3.3
Male 4	58	32.2	209	189	180	169	173	26.7	62	17.2	5.5

index (BMI) of the patients were 59 years and 37 kg/m^2, respectively. The mean length of each procedure was 75 min (range 62–93 min). No intraoperative adverse events were observed. Common post-procedure complaints included sore throat, bloating, and abdominal pain. These resolved within a few hours of the procedure with minimal use of analgesics. Weight loss was reported as a change in BMI and %EWL, which was calculated using the following formula: %EWL = 100 × Weight loss/(Initial weight − Ideal body weight) [3]. Ideal body weight was identified using the midpoint of a medium frame from the 1999 Metropolitan Life Height and Weight Tables.

Table 1 shows weight loss in pounds per patient at 1 month, 3 months, 6 months, and 1 year following the procedure. The long-term follow-up data show a sustained weight loss for all patients ranging from 19 to 36 lbs at 1 year, with the greatest average weight loss (27 lbs) observed at 6 months. At 1 year post-op, the mean body mass index was 33 kg/m^2. Four of the patients were considered successful, with a EWL sustained at 1 year post-procedure, ranging from 21 to 61% with a mean of 38%. One patient experienced a EWL of only 13%, which was attributed to failed lifestyle modification. The mean EWL of the series is 33%.

Discussion

This pilot experience with gastric sleeve volume reduction using endoluminal plication with an endoscopic suturing device is showing early promising results. The patient group was small but consistent with a pilot. Successfully applying this primary weight loss procedure to these patients was critically dependent on careful pre-procedure screening to ascertain an enlarged sleeve anatomy and concurrent lifestyle modification. It is important to closely assess the risk profile of the patient before acceptance into the procedure.

The right tools are key and a full-thickness suturing system, such as the Overstitch device, is a viable tool for gastric tissue approximation in addressing patients weight regain following bariatric surgery [7, 10]. A secure sutured closure can be performed, which is essential for minimizing the risk of leakage and dehiscence. It is also the only commercially available endoluminal suturing device on the market. This type of flexible endoscopic endoluminal procedure for the intervention after the original or primary sleeve is minimally invasive and effective for reducing the enlarged sleeve and resuming sustained weight loss.

When facilitating an intervention procedure, the goal is helping the patient get back on track. This can be achieved with a smaller weight loss or EWL than is conventionally thought of as success. It is also more beneficial to intervene early, before weight gain becomes too excessive. Society accepts Reinhold's criteria for successful excess weight loss for bariatric procedures at 50–75%, and fair weight loss at 25–50%, but we accept a lower range of 15–40% as successful. The measurements of success and failure should be redefined for endoluminal therapies.

Sustained weight loss through 12 months of follow-up is a key observation. Although there was no formal assessment of the revised sleeves via endoscopy or radiologic imaging, the clinical improvement as determined by a mean EWL of 33% suggests that sleeve re-assessment is irrelevant in the setting of an incipient procedure and adherence to diet and lifestyle behavioral change. Sleeve re-assessment would become important should a patient either fail to lose weight or regain weight despite adherence to diet and behavior modification. The endoluminal approach offers the advantage of supplemental revision over time. However, if a patient had a retained fundus, a laparoscopic revision would be the appropriate approach.

Finally, it is important to note that this is a small study of our early experience with the endoluminal approach. Endoluminal approach for revisional surgery is still in development and we have so much to learn to improve our approach, devices, and techniques.

Conclusions

This pilot experience demonstrates weight loss can be achieved in patients who have gained weight in the setting of an enlarged gastric sleeve by further restricting the sleeve using an endoluminal plication suture revision. The endoluminal approach with an endoscopic suturing device for sleeve revision by plication is showing early promising results and expands the management of weight gain following laparoscopic sleeve gastrectomy. This simple approach may offer a significant option for these patients as an interventional strategy in the early phases of weight regain, and prior to reaching a BMI of 40 kg/m^2, as required by traditional surgical approaches. Furthermore, the safety of this approach offers great appeal as a weight loss option.

Compliance with ethical standards

Disclosure Dr. George Eid has no conflict of interest or financial ties to disclose.

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