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ORIGINAL CONTRIBUTIONS

The Use of Intraoperative Endoscopy May Decrease Postoperative Stenosis in Laparoscopic Sleeve Gastrectomy

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Abstract
Background Laparoscopic sleeve gastrectomy (LSG) is becoming one of the most common bariatric surgeries performed worldwide. Leak or stenosis following LSG can lead to major morbidity. We aim to evaluate whether the routine use of intraoperative endoscopy (IOE) can reduce these complications.
Methods All cases of LSG between 2009 and 2015 were reviewed. In all cases, we place the 32 Fr endoscope once we are done with the greater curvature dissection. We perform an IOE at the end of surgery. If IOE shows stenosis, the over-sewing sutures are removed and the IOE is repeated.
Results During the study period, 310 LSG were performed (97.4 % were primary LSG cases). The study population included 213 (68.7 %) females. The average age for our cohort was 34.9 years (range 25–63 years), the average BMI was BMI 45 kg/M2 (range 35–65 kg/M2), and the average weight was 120 kg (89–180 kg). The average length of stay was 2.2 days [1–7]. Our clinical leak rate was 0.3 % (1/310). Our leak rate in primary LSG was 0 % (0/302), and in revisional LSG was 12.5 % (1/8). All IOE leak tests were negative and the only patient with leak had negative radiographic studies as well. In contrast, IOE showed stenosis in 10 LSG cases (3.2 %), which resolved after removing over-sewing sutures. Our clinical stenosis after LSG was 0 %.
Conclusion Routine use of IOE in LSG has led to a change in the operative strategy and could be one of the reasons behind the acceptable leak and stenosis in this series of laparoscopic sleeve gastrectomy.

Keywords Bariatric surgery · LSG · Intraoperative endoscopy · Leak · Stricture

Introduction

Laparoscopic sleeve gastrectomy (LSG) has become an accepted primary bariatric operation. In addition, LSG is technically simpler than laparoscopic Roux-en-Y gastric bypass (LRYGB) and has a shorter learner curve. Furthermore, LSG is positioned between laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic adjustable gastric banding (LAGB) in regard to morbidity, mortality, weight loss, and resolution of comorbidities [1, 2]. For all these reasons, LSG is gaining popularity worldwide and certainly has become the most commonly performed operation in Asia [3]. Despite the overall lower morbidity after LSG, the incidence of leaks after LSG is higher than LRYGB. Moreover, leaks after LSG are more difficult to treat, takes longer to heal, and can leak to catastrophic consequences [4–7].

In order to decrease the incidence of stenosis and leak after LSG, the use of a bougie is recommended. In addition, the size of the bougie correlates well with the leak rate following LSG [8].

In addition, the presence of stenosis at the incisura is thought to contribute to occurrence leak after LSG. While it is difficult to assess the presence of a stenosis at the incisura laparoscopically, this can easily be detected using IOE. Furthermore, stenosis after LSG is diagnosed endoscopically.

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At the Bariatric & Metabolic Institute (BMI) Abu Dhabi similar to Andreas and Ruiz-Tovar et al., we use the endoscope routinely as our bougie in LSG cases [9, 10]. Andreas et al. and Ruiz-Tovar et al. have shown the feasibility and safety of use the endoscope as a bougie in LSG [9, 10]. In general, placing the endoscope is easier than placing the regular bougie because of the light at the end of the endoscope and the easily controllable delectable tip of the endoscope. We herein describe the use of the IOE to evaluate the presence of twist or stenosis at the end of LSG. We hypothesized that the routine use of IOE in LSG helps in detecting stenosis and possibly preventing or detecting leaks after LSG.

Methods

This is a retrospective review of a prospectively collected data related to all consecutive cases of LSG done between June 2009 and February 2015 in our center. This consecutive series includes our entire primary and revisional LSG cases. No cases were excluded from this analysis.

Preoperative Measures

Sequential compression devices are placed on all patients undergoing LSG. In addition, all patients receive intravenous antibiotics (cefazolin), dexamethasone, metoclopramide, and subcutaneous heparin prior to induction of general anesthesia. All patients are endotracheal intubated in the head up (ramp) position. We have adopted an enhanced recovery program and have stopped placing an indwelling urinary catheter routinely. We decompress the stomach following endotracheal intubation.

Operative Technique

Our technique of LSG has been described previously [8]. In summary, LSG transection line starts 3–4 cm from the pylorus, once we complete dissection of the greater curvature of the stomach, a 32 Fr adult endoscope is used as a bougie and placed into the pylorus before we start our first transection. The endoscope is used as a guide and we leave 10 mm space from the endoscope while transecting the stomach. Next, we oversew and invaginate the entire sleeve gastrectomy staple line with 3-0 Vicryl absorbable sutures. We do not place drains routinely. At the end of surgery, we pull the endoscope back into the esophagus and perform intraoperative endoscopy with the pylorus occluded with a grasper. The entire sleeve is fully insufflated while been immersed in saline to check for leak, bleeding, and stenosis.

All endoscopies were performed at the end of surgery by the bariatric surgeon or his assistant using an adult 32 Fr endoscope. This procedure involves direct visualization of the staple line for any evidence of bleeding and performing an air leak test. On average, it takes an extra 5 min to perform the intraoperative endoscopy. If the intraoperative endoscopy revealed no evidence of bleeding, stenosis, or leak, then no drains were placed. The patients start clear liquids once they are awake and no routine postoperative UGI study the next day after surgery. In contrast, if narrowing or a twist was detected, the over-sewing sutures (at the area of the narrowing or twist) were removed and the endoscopy is repeated (video 1-2). We do not place sutures to fix the sleeve to the retroperitoneum. We visualize and assess for the presence of a stricture at the incisura in all LSG cases.

If we encounter a positive leak test on IOE, the area of the leak is re-enforced with sutures, omental patch, and fibrin glue then the air leak test is repeated. We have shown previously in LRYGB that when a persistent and not transient positive air leak test is detected, if the leak persists then a feeding jejunostomy tube and drains are placed [13].

Results

During the study period, 310 LSG were performed (97.4 % were primary LSG cases). All revisional LSG were after LAGB in one or two stages. The study population included 213 (68.7 %) females. The average age for our cohort was 34.9 years (range 25–63 years), the average BMI was BMI 45 kg/M2 (range 35–65 kg/M2), and the average weight was 120 kg (89–180 kg). The average length of stay was 2.2 days. Our clinical leak rate was 0.3 % (1/310). Our leak rate in primary LSG was 0 % (0/302), and in revisional LSG was 12.5 % (1/8). All IOE leak tests were negative, and the patient with a leak after two stage conversion from LAGB had negative radiographic studies as well (CT Abdomen & UGI study). In contrast, IOE showed stenosis in 10 LSG cases (3.2 %), in all these patients, we were unable to access the pylorus endoscopically. However, the stenosis detected on IOE resolved after removing the over-sewing sutures. Our clinical stenosis after LSG was 0 %.

Discussion

The result of this study shows that routine use of IOE at the end of LSG has helped in detecting stenosis at the incisura that was not appreciated laparoscopically. Detecting these findings intraoperatively has led to a change in the operative strategy. We were able to correct stenosis by removing the invagination suture and confirm that the stenosis was corrected endoscopically. We believe this approach of using invagination sutures and then performing IOE to look for stenosis and removing sutures as needed can help in lowering the stenosis rates after LSG. In addition, this approach allows the surgeon some

flexibility in correcting an error of stapling if the transection line was too close to the incisura. In contrast, if the transection line was done flush to the bougie and a stenosis is detected. Then, the patient will need to get converted to LRYGB or have a seromyotomy of the area of the stenosis [11].

In our study, utilizing IOE to actively look for strictures or stenosis, we were able to achieve a 0 % clinical stricture rate despite having 3.2 % intraoperatively detected strictures. Our stenosis rate in LSG is comparable to the published rates of stenosis after LSG. The stenosis rate after LSG in the published literature ranges from 0.7–4 % [11]. We believe that these results are in part due to the routine use of IOE and surgical technique. We were able to achieve these results by having an active strategy at the end of surgery to look for any evidence of stricture or stenosis in LSG (video 1-2). This active strategy allowed us to detect 10/310 (3.2 %) intraoperative stenosis/stricture in LSG. The laparoscopic and endoscopic examination of the LSG is quite useful and gives better information regarding the size of the LSG than laparoscopic examination alone. In addition, the endoscopic anatomy of the incisura is quite constant and is easy to learn. One can easily identify the presence of a stenosis at the incisura if the path of the endoscopy is impeded and one cannot easily negotiate past the incisura (Fig. S1). These stenoses/strictures were corrected and confirmed by repeat IOE and all these patients went to have a smooth postoperative course. This low stricture rate was achieved because whenever a stenosis/stricture is detected on IOE, we remove the re-enforcement sutures at the area of stricture and repeat the endoscopy. The positive predictive value (PPV) of the performing IOE to detect stenosis in LSG was 100 % while the negative predictive value was 100 %.

The presence of stenosis or stricture at the incisura can cause distal obstruction and potentially can lead to a staple line leak. Leaks are the most common feared complication following LSG. In view of the seriousness of the complications associated with leaks, we believe that every effort to prevent their occurrence is worthwhile. Hence, by performing an IOE and detecting leaks or stenosis at the incisura intraoperatively, we could change the operative strategy and potentially prevent these complications.

Our leak rate after LSG compares well to the bariatric surgery programs of the American College of Surgeons National Surgical Quality Improvement Programs [1], and other published leak rates following LSG ranges from 0.7–5 % and can be as high as 20 % [3]. Our clinical leak rate after LSG is 0.3 %, but our series of LSG includes only 310 patients and most of our LSG patients had primary LSG. Ballengar et al. have published the same leak rate following LSG in 529 patients [12]. If we encounter a positive leak test on IOE, the area of the leak is re-enforced with sutures, omental patch, and fibrin glue then the air leak test is repeated. We have shown previously in LRYGB that when a persistent and not transient positive air leak test is detected, if the leak persists then a feeding jejunostomy tube and drains are placed [13] in the operative technique. You had no leaks so if this is a hypothetical then this should be in the discussion; Parikh et al. have shown that a higher leak rate is observed when the bougie size less than 40 Fr is used [8]. In contrast, we were able to achieve a 0.3 % leak after LSG despite using a relatively small bougie (32 Fr bougie). We believe the distance you transect from the bougie is just as important to the bougie size. As we described, we transect 10 mm away from the 32 Fr bougie and we invert and invaginate the entire staple line.

There was no significant added operational cost for performing IOE in our study. Our operating room is equipped with a mobile endoscopy tower so the endoscope and the expertise were available for our bariatric surgery team. In addition, on average, the IOE takes approximately 5 min. Furthermore, we were able to perform IOE on all our patients.

Our study has several limitations; it is a retrospective review of a prospectively maintained data base single center study. In addition, endoscopy is highly operator dependent and the expertise needs to be available within the surgical team to allow for flexibility in performing IOE and the surgeon performing the endoscopy needs to be familiar with the anatomy of LSG. Furthermore, not all bariatric surgeons perform endoscopy at the end of surgery and many do not have the training or the availability of an endoscope in the operating room. Unless the surgeon performs the endoscopy then a gastroenterologist needs to be available at the end of surgery, which might not be practical or possible at all times. To prove definitely the real value of performing IOE in bariatric surgery, we need a randomized study including a large number of patients.

Conclusion

Routine use of IOE in LSG has led to a change in the operative strategy and could be one of the reasons for our low leak and stenosis in this series of laparoscopic sleeve gastrectomy.

Compliance with Ethical Standards

Disclosure Drs Al Hadad, Maasher, Salim, Ibrahim, and Nimeri have no conflicts of interest or financial ties to disclose. "For this type of study, formal consent is not required."

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