



# The Utility of Routine Postoperative Upper Gastrointestinal Swallow Studies Following Laparoscopic Sleeve Gastrectomy

Ido Mizrahi · Alp Tabak · Ronit Grinbaum ·  
Nahum Beglaibter · Ahmed Eid · Natalia Simanovsky ·  
Nurith Hiller

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**Abstract** Laparoscopic sleeve gastrectomy (LSG) has grown in popularity in recent years for the treatment of morbid obesity. Controversy exists regarding the usefulness of upper gastrointestinal (UGI) swallow studies on the first postoperative day in detecting possible complications. The aim of our study was to determine the efficacy and cost benefit of routine UGI studies on the first postoperative day following LSG. We retrospectively reviewed the hospital's records to identify patients who underwent LSG between January 2012 and June 2013. All patients had iodine-based contrast swallow study on the first postoperative day. Reports from all imaging studies and medical files were retrospectively reviewed, and complications were recorded. The Institutional Review Board waived the requirement for informed consent. During the study period, 722 patients underwent LSG. Mean BMI was 43 kg/m<sup>2</sup> (range 25–70). Of the 722 UGI studies, 721 were normal. The 1 abnormal study showed complete obstruction due to an incarcerated hiatal hernia. Five patients presented with a leak (0.7 %). UGI swallow studies failed to detect any of the leaks resulting in a sensitivity of 0 %. All leaks were apparent on computed tomography (CT) scans on postoperative days 2, 5, 7, 23, and 90. The total cost of the UGI swallow studies was \$180,500. Performing routine UGI studies on the first postoperative day following LSG is clearly not cost beneficial. UGI contrast studies are not efficient to screen for suture line leaks. We recommend obtaining a CT scan when there is clinical suspicion for a complication.

**Keywords** Laparoscopic sleeve gastrectomy · Postoperative · UGI swallow study

## Introduction

Worldwide, obesity is increasing constantly and has nearly doubled since 1980. Currently, it is the fifth leading risk for global deaths [1]. Conservative medical treatment of morbid obesity proved inefficient regarding long-term weight loss, reduction of co-morbidities, and improvement in quality of life [2–4]. Currently, bariatric surgery represents the most effective therapeutic option for morbidly obese patients [5, 6].

Over the past decade, laparoscopic sleeve gastrectomy (LSG) has increased in popularity in the USA and worldwide [7, 8]. Supported by numerous studies showing nearly similar metabolic improvement and weight loss reduction when compared with laparoscopic Roux-en-Y gastric bypass (LRYGB), it is now considered a legitimate stand-alone procedure [9, 10]. Weight loss after LSG is attributed mainly to the restrictive effect of reduction in stomach volume and to reduced appetite secondary to the resection of the stomach ghrelin-secreting cells, responsible for appetite regulation. The strengths of LSG being its effectiveness in weight loss, while enjoying a relative low morbidity rate, have further supported this worldwide trend of popularity [11].

The most common and feared complications after bariatric surgery are leak, obstruction, and stenosis. Consequently, many bariatric centers, including our center, have suggested the use of a routine postoperative UGI contrast study before initiating a liquid diet [12, 13]. However, recently, this approach has become dubious because of the additional costs, technical difficulties in monitoring contrast in obese patients, and questionable sensitivity [14–16].

Most of the publications regarding routine postoperative UGI studies after bariatric surgery are referring to LRYGB

I. Mizrahi (✉) · R. Grinbaum · N. Beglaibter · A. Eid  
Department of Surgery, Hadassah-Hebrew University Medical  
Center, P.O.B. 24035, Mount Scopus, 91240 Jerusalem, Israel  
e-mail: idomiz17@gmail.com

A. Tabak · N. Simanovsky · N. Hiller  
Department of Radiology, Hadassah-Hebrew University Medical  
Center, Mount Scopus, Jerusalem, Israel

[12, 13, 15, 16], laparoscopic adjustable gastric banding (LAGB) [17], or a combination of bariatric surgeries [14]. Review of the literature elicited only three previous studies on a limited number of patients, investigating the usefulness of performing routine early postoperative UGI studies following LSG for the detection of complications [14, 18, 19].

The purpose of this study was to investigate the utility and cost benefit of performing routine UGI studies on the first postoperative day following LSG in a large group of patients.

## Materials and Methods

A retrospective chart review was performed to identify all patients who underwent LSG in Hadassah Medical Center between January 2012 and June 2013. Invariably, all patients underwent routine iodine-based contrast swallow study on the first postoperative day. Reports from all imaging studies and medical files were retrospectively reviewed, and complications were recorded. Primary end points included efficacy of UGI swallow studies determined by sensitivity, specificity, negative and positive predictive values, and cost-benefit analysis based on hospital charges for an UGI swallow study and a CT scan. The Institutional Review Board approved the study and waived the requirement for informed consent.

Radiographic examination began with a baseline anteroposterior film of the upper abdomen. The patients were then asked to swallow approximately 60 mL of Gastrografin. A series of spot films was taken immediately after the patient began swallowing the contrast. Fluoroscopy was used to follow the course of the contrast, and multiple views (postero-anterior, left and right obliques) were obtained to allow for adequate visualization. All examinations were reviewed and interpreted by a radiology expert.

Operative technique for this procedure has been previously described [8]. Sleeve gastrectomies were fashioned using multiple stapler firings, beginning 4 cm proximal to the pylorus along a 36-Fr bougie. An intra-operative leak test using methylene blue injection was performed. Over-suturing of the staple line was selectively performed for hemostasis or in cases of staple line mechanical failure. A closed suction drain was placed in proximity to the gastric staple line. All procedures were performed by four expert minimally invasive surgeons.

For all patients, the postoperative care followed a standardized protocol. An UGI swallow study was performed on postoperative day 1 as well as a complete blood count. Liquid diet was started on postoperative day 2, if no leak was observed and if the clinical course was uneventful. After hospital discharge on postoperative day 3, patients were followed at the bariatric surgery clinic by our multidisciplinary bariatric team at 10 days, 3, 6, and 12 months, and yearly thereafter. All

patients were advised to start physical activity, and dietary recommendations were given.

## Results

During the study period, a total of 722 patients (237 males, 485 females) underwent LSG at our institution. Mean age was 41 years (range 14–70), and mean BMI was 43 kg/m<sup>2</sup> (range 25–70). Baseline clinical data is shown in Table 1.

Of the 722 operations, only 1 (0.1 %) was converted to an open approach due to uncontrolled bleeding at the splenic hilum. Forty-five (6 %) hiatal hernias were detected and repaired at the time of surgery. Three revisional surgeries after LAGB were performed. All patients underwent UGI swallow study on the first postoperative day and were available for analysis.

Five patients (0.7 %) developed leaks on postoperative days 2, 5, 7, 23, and 90. No leaks were detected on UGI studies. All leaks were eventually detected using CT scans. CT scans were performed only in these five patients, clinically suspicious of suffering a leak; hence, leaks diagnosed were not an incidental finding. We did not perform CT scans in other patients or for detecting other pathologies. None of the patients that developed leaks were after revisional surgery, but one had a concurrent hiatal hernia repair during his LSG. Four of the five patients required diagnostic laparoscopy. A leak was evident intra-operatively only in one of these cases. All five patients were treated with total parenteral nutrition (TPN). Four of these patients required an endoclip intervention due to persistent leak. Despite conservative therapy attempts, including surgical placement of drains, TPN, and an endoclip, two patients that were diagnosed with a leak on postoperative days 5 and 7 continued to suffer from a leak, as by clinical symptoms and endoscopy. These two patients had eventually undergone a laparoscopic esophago-jejunostomy with near total gastrectomy of the gastric sleeve on days 90 and 124, respectively, after their initial operation. Both operations and postoperative courses were uneventful.

One patient (0.1 %) developed a complete obstruction due to an incarcerated hiatal hernia presenting on the first postoperative day. This was detected by the UGI study, and the patient was taken to the operating room for a revision (Fig. 1). To note, this patient had a normal preoperative UGI study. Of the 722 UGI studies performed, only this 1 study was abnormal (0.1 %). Table 2 summarizes data regarding surgical complications.

To determine efficacy of routine UGI swallow studies after LSG, sensitivity, specificity, as well as positive (PPV) and negative predictive values (NPV) were determined for leak and obstruction. The sensitivity and specificity for detecting a leak was 0 and 100 %, respectively, resulting in a 0 % PPV and

**Table 1** Baseline clinical data

|   |                  |
|---|------------------|
| Age, mean                                     | 41 (range 14–70) |
| Female Gender, <i>n</i> (%)                   | 485 (67)         |
| BMI (kg/m <sup>2</sup> ), mean                | 43 (range 25–70) |
| Revisional surgery, <i>n</i> (%) <sup>a</sup> | 3 (0.4)          |

BMI body mass index

<sup>a</sup> All revisional surgeries were after laparoscopic-adjustable gastric banding

a 99 % NPV. The sensitivity, specificity, NPV, and PPV for detecting obstruction were 100 %.

The costs of a single UGI study and a single CT scan in our institution are approximately \$249 and \$300, respectively. Based on hospital charges, the total cost of UGI studies performed in our study was \$180,500. The total cost of CT scans performed was approximately \$1,500.

## Discussion

Early detection of complications after LSG is critical in the postoperative management, as it may have a positive impact on patient outcomes. However, the utility of routine postoperative UGI studies is controversial in the bariatric surgery literature. Madan et al. concluded that UGI studies are the most predictive of an early leak following LRYGB and that clinical signs alone are not as useful [13]. In contrast, Scheisser et al. have demonstrated a low sensitivity (50 %) for routine UGI studies following LRYGB for detection of leaks. The sensitivity was higher (80 %) when performed for patients with clinical disturbing symptoms [16]. An earlier study by Doraiswamy et al. showed an even lower sensitivity (33 %) for anastomotic leak detection by UGI following

LRYGB. In a recent study by Brockmeyer et al., UGI study was unable to detect any of the six leaks after LSG or of the four leaks after LRYGB [14]. In support of these findings, Triantafyllidis et al. showed that none of the three leaks that occurred in their cohort of 85 patients, following LSG, were detected by routine early UGI studies [19]. Gneccchi et al. also investigated the usefulness of UGI studies following LSG and concluded that it should be performed only in symptomatic patients. Nevertheless, their study was limited by the relatively low number (101) of participants [18].

In our study, on the largest cohort of patients (722) described to date, none of the five leaks from the gastric staple line were detected by the routine UGI swallow studies on postoperative day 1. This correlates with the findings of previously published studies [14, 18, 19]. Various reasons may account for the low detection rate in our study. First, the UGI studies were obtained on the first postoperative day regardless of the clinical symptoms. Theoretically, it may be that leaks were still not formed by the time of the study or contained by tissue edema expected after surgery. Sakran et al. have already found that the median postoperative day for the clinical presentation of a leak after LSG was day 7 [20]. Second, our relatively low leak rate (0.7 %) may further account for the low sensitivity rate. Lastly, symptomatic leaks may be a cause of a micro-leak, one that would not be apparent on an UGI study as frank extravasation of contrast but would show signs of a leak on CT scan (e.g., air bubbles, abscess). In support of this, only one leak out of four that required revision in the operating room was evident during diagnostic laparoscopy, despite air insufflation test and methylene blue injection.

The sensitivity and specificity for obstruction or stricture formation was 100 % as presented by one case of complete obstruction due to an incarcerated hiatal hernia (Fig. 1). This may come in support of our routine protocol, suggesting that UGI studies may show signs of transient causes of obstruction, such as hematoma or mural edema, preventing advancement of a patients' diet. Nevertheless, this patient demonstrated complete dysphagia, and an UGI study would have been obtained even in institutions where a routine protocol is not implemented. To note, that other potential cause of obstruction such as strictures develop mainly during the first 6 weeks after surgery, and a routine UGI on the first postoperative day will probably not predict the formation of one.

Previous studies have shown that clinical symptoms such as, tachycardia, abdominal pain, and respiratory distress are highly suggestive of a leak following LRYGB [14, 21, 22]. Of our five patients diagnosed with a leak, five had severe upper abdominal pain, four had tachycardia, and two had tachypnea as their presenting symptoms. These symptoms, obviously, raised the suspicion for a leak, and a CT scan was obtained confirming the unfortunate diagnosis. This emphasizes further the importance of monitoring carefully the patient's clinical symptoms and signs.



**Fig. 1** UGI study on postoperative day 1 following laparoscopic sleeve gastrectomy showing an incarcerated hiatal hernia

**Table 2** Complications data

| Complication | POD at presentation | Presenting symptom                      | Laboratory data      | UGI      | CT       | Treatment   |
|--------------|---------------------|---|----------------------|----------|----------|---|
| Leak         | 2                   | Upper abdominal pain, tachycardia       | WBC $15 \times 10^3$ | Negative | Positive | Re-operation, TPN, percutaneous drainage          |
| Leak         | 5                   | Epigastric pain, tachycardia, tachypnea | WBC $11 \times 10^3$ | Negative | Positive | Re-operation, TPN, endoclip, esophago-jejunostomy |
| Leak         | 7                   | Epigastric pain, tachycardia, tachypnea | WBC $14 \times 10^3$ | Negative | Positive | Re-operation, TPN, endoclip, esophago-jejunostomy |
| Leak         | 23                  | LUQ pain                                | WBC $16 \times 10^3$ | Negative | Positive | Re-operation, TPN, endoclip                       |
| Leak         | 90                  | Left flank pain, tachycardia            | WBC $20 \times 10^3$ | Negative | Positive | Endoclip, TPN, percutaneous drainage              |
| Obstruction  | 1                   | Dysphagia                               | WBC $12 \times 10^3$ | Positive | Positive | Re-operation, TPN                                 |

POD postoperative day, UGI upper gastrointestinal study, CT computed tomography, WBC white blood cell ( $10E9/L$ ), TPN total parenteral nutrition, LUQ left upper quadrant

Schiesser et al. suggested the use of CT scans with oral contrast in selected patients presenting with clinical findings suspicious for a leak [16]. All cases of leak in our study were diagnosed by CT scans. Thus, we too believe that in cases where leak is suspected, CT scans are superior to UGI swallow studies in demonstrating extra-luminal pathologies, such as an extra-luminal hematoma or abscess, as well as its ability to detect very small amount of free intra-peritoneal air and contrast extravasation.

The cost of routine UGI studies after bariatric surgery has been addressed in previous studies [13, 23]. This issue of cost benefit is of paramount importance for every health organization, especially when considering the increase in bariatric surgery in general and in LSG in particular, worldwide. Some have proposed that the early diagnosis and treatment of a leak easily justifies the cost [13]. The cost of the UGI studies during our study period, of 18 months, was \$180,500. The cost for five CT scans obtained for the patients that presented with clinically disturbing signs was approximately \$1,500. If instead of our routine UGI protocol, CT scans would have been obtained only for these five patients, it would have saved our institute \$179,000. Clearly, the routine use of UGI studies was of no cost benefit when considering it did not diagnose any of the leaks.

Advocates of a routine early UGI study claim it provides documentation of the postsurgical anatomy and may stand in support of the surgeon if medico-legal issues were to present. It also allows evaluation of performance, especially for general surgery residents in training programs. Gastroesophageal reflux may be identified and treated in the early postoperative period, preventing the symptoms of reflux to follow. Finally, if failure to achieve weight loss was to happen, the surgeon would have a baseline UGI study to compare with. This is especially true after LSG, in which one of the theories for failure is dilation of the sleeve.

In our opinion, bariatric surgeons practicing LSG should be aware of the clinical symptoms, specifically tachycardia, abdominal pain, and respiratory distress, suggesting a gastric staple line leak. These symptoms should prompt for further selective radiological evaluation, preferably with CT scans. Routine UGI studies are of no cost benefit but may serve as an evaluation tool in training programs.

**Conflict of Interest** Dr. Mizrahi, Dr. Tabak, Dr. Grinbaum, Dr. Beglaibter, Dr. Eid, Dr. Simanovsky, and Dr. Hiller have no conflicts of interest or financial ties to disclose.

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