ORIGINAL CONTRIBUTIONS

The Effect of Laparoscopic Sleeve Gastrectomy with Concomitant Hiatal Hernia Repair on Gastroesophageal Reflux Disease in the Morbidly Obese

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Abstract

Background The effect of laparoscopic sleeve gastrectomy (LSG) on gastroesophageal reflux disease (GERD) is controversial. Although concomitant hiatal hernia repair (HHR) at the time of LSG is common and advocated by many, there are few data on the outcomes of GERD symptoms in these patients. The aim of this study was to evaluate the effect of concomitant HHR on GERD symptoms in morbidly obese patients undergoing LSG.

Methods A single institution, multi-surgeon, prospectively maintained database was examined to identify patients who underwent LSG and concomitant HHR from December 2010 to October 2013. Patient characteristics, operative details, and postoperative outcomes were analyzed. Standardized patient questionnaires administered both pre- and postoperatively were utilized. Primary endpoints included subjective reflux symptoms and the need for antisecretory therapy. Weight loss was considered a secondary endpoint.

Results Fifty-eight patients were identified meeting inclusion criteria (LSG+HHR), with a mean follow-up of 97.5 weeks (range 44–172 weeks). The mean age of the cohort was 49.5 ± 11.2 years, with 74.1 % being female. Mean preoperative BMI was 44.2 ± 6.6 kg/m^2. Preoperative upper gastrointestinal contrast series was performed in all patients and demonstrated a hiatal hernia in 34.5 % of patients and reflux in 15.5 % of patients. Preoperatively, 34.6 % ($n=26$) of patients reported subjective symptoms of reflux and/or required daily antisecretory therapy. After LSG+HHR, 34.6 % of symptomatic patients had resolution of their symptoms off therapy while the rest remained symptomatic and required daily antisecretory therapy; 84.4 % of patients that were asymptomatic preoperatively remained asymptomatic after surgery. New onset reflux symptoms requiring daily antisecretory therapy was seen in 15.6 % of patients who were previously asymptomatic. Post surgical weight loss did not correlate with the presence or resolution of reflux symptoms.

Conclusion Based on our data, LSG with concomitant HHR improved GERD symptoms or the need for daily antisecretory therapy only in a third of symptomatic patients. Furthermore, 15.6 % of asymptomatic patients developed de novo GERD symptoms despite a HHR. In patients with a documented hiatal hernia, HHR does not lead to GERD resolution or prevention after LSG, indicating the need for appropriate patient counseling and further study.

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Introduction

The prevalence of gastroesophageal reflux disease (GERD) in obese patients is markedly increased compared with the general population [1]. Several studies have demonstrated that obesity is an independent risk factor for GERD due to impairment of the normal anatomic barriers to reflux [2–5]. While Roux-en-Y gastric bypass (RYGB) has been demonstrated to alleviate gastroesophageal reflux, it is not clear whether laparoscopic sleeve gastrectomy (LSG) promotes or worsens GERD [6, 7]. In fact, there are mixed data on the effects of LSG on preexisting GERD and the generation of "de novo" GERD in bariatric patients after LSG. In a recent meta-analysis by Karmali et al., a review of 15 studies found that 4 studies reported increased incidence of GERD after sleeve gastrectomy while 7 studies reported a reduced GERD prevalence after sleeve gastrectomy [8]. Similarly, manometric testing of the lower esophageal sphincter before and after LSG has yielded conflicting results [9–12].

Strategies to reduce the incidence of GERD after LSG include complete removal of the gastric fundus, avoiding creation of a narrow or "corkscrew" sleeve, and routine repair of identified hiatal hernias [13]. Soricelli et al. found a 73.3 % remission of GERD in patients who had concomitant hiatal hernia repair performed during LSG [14]. They also found no de novo GERD symptoms in asymptomatic patients undergoing LSG with concomitant hiatal hernia (HH). Daes et al. reported a decreased incidence of GERD from 49.2 to 1.5 % at 6–12 months with concomitant hiatal hernia repair [13]. Still, the role of hiatal hernia repair during sleeve gastrectomy has yet to be well defined. At the present time, there are no randomized prospective trials evaluating the role of hiatal hernia repair concomitantly with sleeve gastrectomy. The aim of this paper was to review our data on the effects of LSG with concomitant hiatal hernia repair (HHR) on gastroesophageal reflux.

Methods

Patients

A single institution, multiple surgeon, prospectively maintained bariatric database was used to retrospectively identify patients who underwent LSG and concomitant HHR from December 2010 to October 2013 (Table 1). All adult patients undergoing laparoscopic sleeve gastrectomy with concomitant hiatal hernia repair were considered eligible for the study. Patients with a previous history of bariatric surgery or an anti-reflux procedure were excluded. Fifty-eight patients were identified meeting inclusion and exclusion criteria. All patients underwent a routine preoperative workup including history and physical examination, laboratory evaluation, nutrition and behavioral consultation, and further testing as indicated. All patients underwent preoperative upper gastrointestinal contrast radiologic study prior to surgery (Table 2). Standardized patient questionnaires were administered preoperatively and at subsequent postoperative clinic visits. Primary endpoints included the presence of subjective reflux symptoms and the need for daily antisecretory therapy. Postoperative weight loss was considered a secondary endpoint. Questionnaire results and the patient chart were reviewed to obtain data on primary and secondary endpoints. Patients in this study were considered to have symptomatic reflux if they endorsed symptoms or if they were taking any antisecretory medication defined as the use of H2-blockers or proton pump inhibitors.

Weight loss was calculated as percent excess BMI reduction (EBMIR) using the following calculation: (preoperative BMI − current BMI)/(preoperative BMI − 25)×100.

Surgical Procedure

All patients were administered heparin for venous thromboembolism prophylaxis prior to incision. Antibiotic prophylaxis was administered in compliance with our bariatric institutional protocol. A four- or five-port approach with a liver retractor was used. The fundus was fully mobilized, exposing the left crus in all cases. The gastric sleeve was fashioned over a 36–40 French bougie using a linear cutting stapler beginning 2–8 cm proximal to the pylorus and ending near the angle of His. Care was taken to transect the fundus off the sleeve approximately 1 cm lateral to the angle of His to avoid placing the most proximal staple line at the gastroesophageal junction. Dissection and inspection of the hiatus was indicated by the presence of a hiatal hernia on preoperative imaging or by gross evidence of indentation at the phrenoesophageal membrane at the time of surgery. Closure of the hiatal defect was performed in a posterior fashion using one or more interrupted nonabsorbable sutures between the right and left crural pillars. A

Table 1 Patient demographics

Gender	Male 43 (74.1 %); female 15 (25.9 %)
Age (years)	Mean 49.5±11.2; range 20–67
BMI (kg/m^2)	Mean 44.2±6.6; range 35–63
Follow-up (weeks)	Mean 95±37.9; range 44–172

Table 2 Preoperative UGI findings (n=58)

Demonstration of hiatal hernia	20/58 (34.5 %)
No evidence of hiatal hernia	37/58 (63.8 %)
Demonstration of reflux	
Symptomatic patients	9/26 (34.6 %)
Asymptomatic patients	0/32 (0)

sizing bougie was not routinely used during the cruroplasty. There was no mesh used in the repair of the hiatal hernia in this group. All patients underwent successful LSG and HHR.

Results

From December 2010 to October 2013, 58 patients underwent LSG and concomitant HHR at our institution. The mean age of the group was 49.5±11.2 years, with 74.1 % of patients being female. The average BMI at the time of surgery was 44.2±6.6 kg/m^2 and the mean follow-up period was 97.5 weeks (range 44–172 weeks). A preoperative upper gastrointestinal series (UGI) was obtained on all 58 patients and revealed a hiatal hernia in 34.5 % of patients. The remaining hiatal hernias were identified at the time of surgery. The UGI also demonstrated radiographic evidence of reflux in 15.5 % of patients.

There were no mortalities or major complications such as leak, sleeve stenosis, or stricture in the study group. Preoperatively, 26 (44.8 %) patients had subjective symptoms of GERD and/or required daily anti-reflux medication. Postoperatively, 17 (65.4 %) of these patients remained symptomatic, while 9 (34.6 %) had resolution of their symptoms. Preoperatively, 32 patients (55.2 %) denied reflux symptoms. In this asymptomatic cohort, 84.4 % remained asymptomatic while 15.6 % developed de novo reflux symptoms that required treatment with daily medication.

At the time of surgery, there was no difference in BMI between symptomatic patients, 43.3±6.1 kg/m^2 and asymptomatic patients, 44.8±6.9 kg/m^2 (p=0.39). At the time of longest follow-up, symptomatic patients had a mean BMI of 34.5±5.3 compared to a mean BMI of 35.3±5.8 in asymptomatic patients (p=0.59). Similarly, percent excess BMI reduction was not statistically different between the symptomatic group versus the asymptomatic group (48.2 versus 43.4 %, respectively; p=0.38). There was no statistical difference in percent excess BMI reduction between patients that were asymptomatic prior to surgery and remained asymptomatic compared to those who developed de novo reflux symptoms (42 versus 50.8 %, respectively; p=0.52). Similarly, there was no statistical difference in percent excess BMI reduction in patients that were symptomatic preoperatively and

remained symptomatic after surgery compared to those who were found to be asymptomatic postoperatively (51.6 versus 41.8 %, respectively; p=0.21) (Table 3).

Discussion

The effect of sleeve gastrectomy on GERD remains controversial, and the relationship between hiatal hernias, sleeve gastrectomy, and GERD requires further discussion. The impetus for crural repair may stem from observations of increased incidence of reflux symptoms after sleeve gastrectomy [15]. Particularly concerning are reports of increased incidence of "de novo" symptoms of gastroesophageal reflux after LSG [16]. A recent review of 13 studies by Laffin et al. found that 8 studies reported increased GERD after sleeve gastrectomy while 5 studies reported reduced GERD after LSG [17]. Howard et al. reported an 82 % worsening of GERD symptoms after LSG [18]. Tai et al. noted an increase in the prevalence of GERD symptoms (12.1 versus 47 %) and erosive esophagitis (16.7 versus 66.7 %) after LSG [19]. Carter et al. reported persistent GERD even after significant weight loss in patients with preoperative symptoms along with an increased risk of postoperative reflux symptoms in previously asymptomatic patients [20]. Cottan et al. reported a series of 126 patients undergoing LSG with a 20 % incidence of GERD at 12-month follow-up [21]. Nocca et al. reported an 11.8 % incidence of GERD at 24 months following LSG [22]. Hamoui et al. reported an incidence of 12.7 % GERD at 13 months after LSG in 131 patients [23]. Based on the current review of literature, one can only conclude that there is no clear consensus on the effects of sleeve gastrectomy on preexisting GERD or the development of new gastroesophageal reflux symptoms.

While GERD is often associated with a hiatal hernia, the presence of the latter is not necessary for the diagnosis of the former. Indeed, many patients with hiatal hernias are asymptomatic and do not require treatment. Likewise, there are patients who suffer from GERD who do not have hiatal hernias. There is, however, evidence to suggest that there is an increased incidence of GERD in morbidly obese patients with a hiatal hernia than in those without a hiatal hernia [24]. The lower esophageal sphincter (LES) is the primary barrier to

Table 3 Outcomes on reflux after surgery

Preoperative	Postoperative	Number (%)	EBMIR (%)
Symptomatic reflux preoperatively (n=26) mean BMI 43.3	Symptomatic	17 (65.4 %)	42 %
	Asymptomatic	9 (34.6 %)	41.8 %
Asymptomatic preoperatively (n=32) mean BMI 44.8	Asymptomatic	27 (84.4 %)	42 %
	De novo symptomatic	5 (15.6 %)	50.8 %

preventing reflux of gastric contents into the esophagus. The LES is composed of several contributing forces including the musculature of the distal esophagus, the sling fibers running from the cardia to the lesser curve, compression of the distal esophagus by the diaphragm during inspiration, and transmural forces secondary to the intraabdominal pressure in the abdominal cavity [25]. Morbid obesity may compromise many of the physiologic barriers to an appropriately functioning LES including increasing transient LES relaxation. While the impetus for HHR may be driven by clinical data suggesting an increased incidence of GERD after LSG, the physiologic explanation has yet to be fully elucidated.

The proposed mechanisms for increased GERD after sleeve gastrectomy are multiple. Petersen et al. reported a significant decrease in lower esophageal sphincter pressure after sleeve gastrectomy in 85 % of patients [26]. Yehoshua et al. demonstrated decreased gastric compliance and increased gastric pressure after sleeve gastrectomy [27]. Increased gastric pressure combined with disruption of the angle of His may contribute to increased reflux as well [28]. Disruption of the cardiac sling fibers have also been correlated with a decrease in LES tone. Nahata et al. proposed the concept that impaired ghrelin signaling as predisposing patients to GERD after sleeve gastrectomy [29]. The routine repair of small hiatal hernias may contribute to LES dysfunction by disrupting the normal anatomical barriers to reflux in order to perform the repair. Potential breakdown of the repair may also lead to worsening of the hiatus hernia given the dissection that takes place in order to perform the cruroplasty.

In our study, we found that some patients undergoing LSG with concomitant HHR had an improvement in GERD symptoms. Nonetheless, two thirds of symptomatic patients remained symptomatic after surgery, even at time points in excess of 18 months postoperatively. Even more concerning was the finding that 15.6 % of previously asymptomatic patients developed de novo reflux symptoms after LSG with concomitant HHR. The physiological mechanisms underlying resolution of symptoms in previously symptomatic patients are likely related to hiatal hernia reduction, posterior cruroplasty, and long-term weight loss. Still, 65.4 % of symptomatic patients continued to have reflux after surgery despite greater than 50 % reduction in excess BMI. We believe that HHR may modify the normal anatomic and physiologic antireflux mechanisms as well as properties of the LES in a way that may contribute to reflux after LSG. Our findings echo recently reported results by Iovino et al., which demonstrated that patients who underwent LSG with HHR did not show any improvement in the prevalence and intensity-frequency scores of typical GERD symptoms and had significantly higher heartburn frequency-intensity scores than patients who underwent LSG alone [30]. The utility of concomitant HHR along with bariatric procedures has been questioned in other settings too, including adjustable gastric banding. A recent study by Tavakkoli and Ardestani on a large cohort of gastric banding patients raised the question of whether or not bariatric patients should undergo repair of small hiatal hernias after the authors found that HHR had minimal effect on postoperative improvement in reflux symptoms [31]. Furthermore, in the absence of high-quality data on the natural course of GERD in patients with hiatal hernias undergoing LSG, it is difficult to gauge the efficacy of HHR on reflux symptoms.

Our data also questions the utility of preoperative UGI in identifying the presence of a hiatal hernia. A recent study by Che et al. reported the presence of hiatal hernia in nearly 40 % of morbidly obese patients [32]. In our cohort of patients, a hiatal hernia was identified in only 34.5 % of patients who ultimately had a hiatal hernia identified at the time of surgery. Similarly, UGI demonstrated gastroesophageal reflux in 34.6 % of patients who were otherwise known to have symptomatic reflux. Moreover, in our study, UGI failed to identify a hiatal hernia when one was present nearly two thirds of the time. While there is significant debate regarding the most useful evaluation of the hiatus (e.g., endoscopy, UGI, manometry, intraoperative assessment) future discussions of this topic hinge upon a more standardized way to diagnose, measure, and delineate hiatal hernias.

The potential contribution of sleeve gastrectomy on GERD remains to be determined. Furthermore, the role of routine hiatal hernia repair in conjunction with sleeve gastrectomy needs to be evaluated in a systematic fashion in order to determine best practice guidelines. Further research should focus on standardized GERD questionnaires, imaging studies, esophageal manometry, and 24-h pH measurements both preoperatively and at scheduled intervals postoperatively. Moreover, long-term data is required to fully understand the effects of sleeve gastrectomy and hiatal hernia repair on GERD in the bariatric surgical population following weight loss. Procedure selection for the morbidly obese patient should include a frank discussion of this uncertainty as well as alternative bariatric procedures.

This study has several limitations. First, it is a retrospective study with a relatively small sample size and mean follow-up time of less than 2 years. Since this was a retrospective study, the patient questionnaires were not designed to gauge the severity, intensity, or duration of GERD. As a result, our primary endpoints simply measure the presence or absence of reflux symptoms as reported by patients and the need for antisecretory therapy. Self-reported symptoms of reflux are not as reliable as standardized GERD questionnaires. Patients in this study did not routinely undergo esophageal manometry, endoscopy, or 24-h pH measurement. The presence of a hiatal hernia was detected preoperatively with the use of an upper gastrointestinal contrast study along with intraoperative assessment of the hiatus. Neither the imaging study nor inspection of the hiatus was standardized in advance. Moreover, the use of antisecretory therapy in

postoperative patients was not performed in standardized fashion and relied upon the discretion of the practicing surgeon. Our study also did not take into account the size of the hernia in a systematic fashion, although the overwhelming majority of hernias were categorized as small either by the radiologic report or the surgeon's notes. Future prospective studies in this area will need to address these concerns.

Conclusion

Contrary to previously published studies, this investigation failed to demonstrate a relationship between improvement in GERD symptoms and the repair of hiatal hernias at the time of sleeve gastrectomy. Only one third of patients who were symptomatic prior to surgery were improved by the repair of the hiatal hernia. Furthermore, 15 % of patients who had a hiatal hernia but were asymptomatic suffered GERD symptoms after sleeve gastrectomy and concomitant HHR. These findings would highlight that HHR does not lead to complete GERD resolution or prevention after LSG, indicating the need for appropriate patient counseling regarding expected outcomes and bariatric procedure selection.

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