



Esophagus

Presented at the Academic Surgical Congress 2019

The influence of gastroesophageal reflux symptoms on patient satisfaction after sleeve gastrectomy

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ARTICLE INFO

Article history:

Accepted 2 July 2019

Available online 23 August 2019

ABSTRACT

Background: Sleeve gastrectomy has become the most common procedure performed for weight loss. But emerging data indicate that this procedure can result in lifestyle-limiting gastroesophageal reflux disease. The influence of these gastroesophageal reflux disease symptoms on patient satisfaction with the procedure has not been explored.

Methods: Using a statewide, bariatric-specific data registry, we studied 6,608 patients who underwent laparoscopic sleeve gastrectomy from 2013 to 2017. We used the Gastroesophageal Reflux Disease Health-Related Quality of Life questionnaire, which is 10 questions, each ranging from 0 (no symptoms) to 5 (severe symptoms). To assess the impact of sleeve gastrectomy on patient satisfaction, we calculated the change in this score at baseline versus 1 year after the procedure. We stratified the change in the gastroesophageal reflux disease score into 5 even-sized groups (quintiles). We then examined the relationship between change in the gastroesophageal reflux disease score and patient satisfaction at 1 year. We used generalized linear mixed models to assess the variation in patient satisfaction explained by the change in the gastroesophageal reflux disease score, excess body weight loss at 1 year, and other patient outcomes (serious complications, readmission, and reoperations). We controlled for patient factors (age, sex, race, and comorbidities) and year of sleeve gastrectomy.

Results: The average change in the gastroesophageal reflux disease score was 1.62 (range: –48 to 48); however, the change in the gastroesophageal reflux disease score varied across quintiles with a –7.3-point (range: –48 to –3) worsening in the bottom quintile versus a 2.6-point (range: 7 to 48) improvement in the top quintile. Overall, 77.7% of patients were satisfied, but the proportion of patients satisfied was highly dependent on whether their reflux symptoms improved or worsened. Only 48.9% in the bottom quintile were satisfied, compared with 78.1% in the top quintile (<.0001). In the multivariate model, changes in patient-reported gastroesophageal reflux disease score were the most predictive of patient satisfaction, explaining 10.1% of the variation in 1 year satisfaction. Among patients in the bottom quintile, reflux symptoms explained 30.2% of variation compared with 2.3% in quintiles with little change or improvement in reflux. Moreover, excess body weight loss explained only 2% of variation in satisfaction and <1% was explained by patient outcomes (serious complications, readmissions, reoperations, or surgical complications).

Conclusion: In this statewide study of sleeve gastrectomy, we demonstrated that gastroesophageal reflux symptoms are an important determinant of 1 year satisfaction, particularly among patients whose symptoms worsened the most.

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Presented at the 2019 Annual Academic Surgical Congress, Houston, TX, February 7, 2019.

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Introduction

Gastroesophageal reflux disease (GERD) has emerged as the Achilles' heel of sleeve gastrectomy (SG). For example, in the recent randomized clinical Swiss Multicentre Bypass or Sleeve Study trial, 31.8% of patients experienced worsening of GERD symptoms after

Table 1
Average GERD survey responses—at baseline and follow-up—and change in GERD (delta GERD) from baseline

	Baseline	1-y follow-up	Change from baseline to 1-y follow-up
1. How bad is your heartburn?	1.05	0.80	0.25
2. Do you have bloating or gassy feelings?	1.19	1.04	0.14
3. Does heartburn change your diet?	0.75	0.56	0.18
4. Heartburn when standing up?	0.72	0.54	0.18
5. Heartburn lying down?	0.91	0.66	0.25
6. If you take medication, does this affect your daily life?	0.38	0.30	0.08
7. Heartburn after meals?	0.90	0.69	0.21
8. Do you have pain with swallowing?	0.14	0.11	0.04
9. Does heartburn wake you from sleep?	0.67	0.45	0.21
10. Do you have difficulty swallowing?	0.29	0.21	0.08
Average GERD score of all 10 responses	0.70	0.54	0.16
Sum/total GERD score of all 10 responses	6.99	5.36	1.62

Response categories include: 0 = no symptoms; 1 = noticeable, but not bothersome; 2 = noticeable, bothersome, but not every day; 3 = bothersome daily; 4 = bothersome and affects daily activities; 5 = incapacitating to do daily activities.

SG, compared with only 6.3% in gastric bypass patients.¹ These symptoms affect patient quality of life.² Understanding the influence of GERD in patient satisfaction with SG, therefore, is important when providing information to help patients select procedures.

The influence of reflux symptoms on patient satisfaction with SG has not been explored. Earlier studies evaluating satisfaction and quality of life after bariatric surgery have focused on the impact of weight loss after surgery.^{3,4} Moreover, although there have been comparative studies on which bariatric procedures affect GERD, little is known about how compromised quality of life due to GERD drives patient satisfaction.^{5–7} Given that SG is the most common bariatric procedure performed in the United States, it is important to better understand the effect of SG on GERD symptoms and patient satisfaction, because it may be an important factor in helping patients decide which procedure to undergo.

In this context, we analyzed data from a prospective, statewide, bariatric data registry. A validated, disease-specific quality-of-life measure for GERD was used to assess the relationship between change in disease severity score and patient satisfaction 1 year after SG.

Methods

We studied 6,608 patients who underwent laparoscopic SG (2013 to 2017) from the Michigan Bariatric Surgery Collaborative, a payer-funded, statewide consortium that utilizes a bariatric-specific, clinical data registry for quality improvement.⁸ In this registry, in addition to the clinical data submitted by participating hospitals, patients also complete surveys at baseline preoperatively and at yearly follow-ups postoperatively. For this study, we examined patient responses to the Gastroesophageal Reflux Disease Health-Related Quality of Life (GERD-HRQL) questionnaire at baseline and 1 year and their satisfaction with the present condition at 1 year after SG.⁹ We only included patients who had undergone SG and had completed the questionnaire at baseline and at 1 year. We excluded 0.4% of patients who had GERD surgery. No revisions and no other procedures were included.

The GERD-HRQL survey included 10 questions (Table 1) to assess severity of reflux symptoms, using a 0–5 Likert scale, ranging from 0 (no symptoms) to 5 (severe symptoms). We assessed patient satisfaction with their procedure at 1 year, based on a separate survey instrument with the following 3 response options: satisfied, neutral, or dissatisfied.

In addition to patient survey data, patient characteristics included age at operation; sex; race; preoperative body mass index; insurance type; history of smoking; comorbidities including hypertension, hyperlipidemia, diabetes, cardiovascular disease,

musculoskeletal disorder, gastroesophageal reflux disease, obstructive sleep apnea, mobility problems, liver disorder, lung disease, peptic ulcer disease, and venous thromboembolism; and psychologic conditions. To evaluate predictors of satisfaction, we used the change in total GERD score, % excess body weight loss (EBWL) at 1 year postsurgery, and postoperative outcomes, including 30-day serious complications, readmissions, reoperations, and operative complications. We classified serious complication as grades 2 and 3 of the Clavien–Dindo classification system.¹⁰ Operative complications included leak, obstruction, infection, and hemorrhage.

Statistical analysis

We calculated the change in total GERD-HRQL scores (delta GERD) for 10 questions (range: 0–50) from baseline to 1 year. Patients were then divided into 5 groups (quintiles) based on the degree of change in their delta GERD score. The bottom quintile was composed of patients with increases in score from baseline to 1 year (negative delta GERD score) that represents worsening of GERD symptoms. The top quintile was composed of patients with decreases in score from baseline to 1 year (positive delta GERD score) that represents improvement in GERD symptoms.

We compared patient characteristics by their degree of satisfaction. We combined patients who were neutral and dissatisfied and compared them with patients who were satisfied. We started by comparing the predictors of satisfaction by their degree of satisfaction. We then used univariate and multivariate generalized linear mixed models to assess the proportion of variance in satisfaction explained by change in GERD score (delta GERD), percent excess body weight loss (%EBWL) at 1 year postsurgery as continuous variables, and 30-day patient binary outcomes, including serious complications, readmission, reoperations, and operative complications, among all patients and by quintiles of delta GERD score. Multivariate models controlled for patient factors (age, sex, race, preoperative BMI, hiatal hernia repair, and comorbidities) and year of the operation.

Furthermore, we compared the relationship between the GERD score at baseline and quintiles of delta GERD and the relationship between the GERD score at baseline and satisfaction at 1 year.

All reported *P* values were 2 sided, and a value of < .05 was used as threshold for statistical significance. All statistical analyses were performed using SAS v 9.4 (SAS Institute, Cary, NC, USA).

Results

We excluded 8,988 patients from our study because of failure to complete 1 or multiple surveys. A total of 9,774 patients (63%)

Table II
Patient characteristics, by level of patient satisfaction at 1-y follow-up

	All patients	Satisfied	Neutral	Dissatisfied	P value
Number of patients	6,608	5,132	1,139	337	
Age in y (mean)	46.49	46.86	45.22	45.09	<.0001
Male sex (%)	20.79	22.64	15.19	11.57	<.0001
Race (%)					
White	81.82	83.63	75.02	77.04	<.0001
Black	11.05	9.45	16.65	16.62	<.0001
Other race	7.13	6.91	8.33	6.34	.472
Private insurance (%)	27.29	27.71	26.34	24.04	.100
Preoperative body mass index (mean)	47.04	46.94	47.3	47.57	.066
Concurrent hiatal hernia repair (%)	34.69	35.37	33.01	29.97	.017
Comorbidities (%)					
Number of comorbidities (mean)	4.47	4.39	4.62	5.03	<.0001
Comorbidities >5	30.72	29.44	33.36	41.25	<.0001
Musculoskeletal disorder	71.04	70.5	72.61	73.89	.067
Cardiovascular disease	51.35	51.34	51.45	51.04	.967
Hyperlipidemia	46.87	47.1	46.09	45.99	.509
Gastroesophageal reflux disease	53.62	51.48	58.82	68.55	<.0001
Psychologic conditions	55.27	53.49	60.4	64.99	<.0001
Sleep apnea	45.84	46.02	44.86	46.29	.717
Smoking	39.45	37.99	42.73	50.60	<.0001
Diabetes	28.71	28.27	29.24	33.53	.056
Cholelithiasis	28.84	28.18	29.68	36.20	.004
Lung disease	25.05	23.56	28.36	36.50	<.0001
Urinary incontinence	18.3	18.3	17.73	20.18	.715
Mobility problems	4.28	4.17	4.39	5.64	.252
Liver disorder	12.41	12.26	12.73	13.65	.414
Venous thromboembolism	4.52	4.23	5.62	5.34	.053
Peptic ulcer disease	3.00	3.00	2.55	4.45	.539
GERD RX	43.31	41.21	48.73	56.97	<.0001

completed the GERD-HRQL questionnaire at 1 year, and a total of 10,802 patients (69%) completed the satisfaction question at 1 year. Our total study population included the 42.2% of patients (6,608 patients) who completed all the surveys (baseline GERD-HRQL questionnaire, 1 year GERD-HRQL questionnaire, and 1 year satisfaction question). In our multivariate analysis, we grouped the 6,608 patients into quintiles based on the degree of change in their delta GERD score and compared the bottom quintile with worse delta GERD (1,266) to quintiles 2–5 with improved delta GERD (5,342). We grouped dissatisfied patients (5%) and neutral patients (17%) together and compared them with satisfied patients (78%).

Patient characteristics across all satisfaction levels are presented in Table II. Patients who were dissatisfied with the procedure were more likely to have preoperative GERD (68.6% of dissatisfied patients versus 51.5% of satisfied patients) and a greater number of comorbidities. Patients who were dissatisfied with the procedure were also more likely to be black and female compared with patients who were satisfied. Furthermore, patients who were dissatisfied with the procedure were less likely to have a concurrent hiatal hernia repair. Although most of the comorbidities remained similar among satisfaction groups, 6 of the comorbidities were significantly different; these included the average number of

comorbidities, comorbidities greater than 5, psychologic conditions, smoking, lung disease, and prior GERD medication.

The mean total GERD score at baseline was 7 (Table III). At a 1 year follow-up, the total mean GERD score was 5.4, showing a 1.6 improvement. The most important t predictor of patient satisfaction was the change in total GERD score. Patients who reported being dissatisfied had a mean increase (worsening) in GERD score of –7.3 when compared with satisfied patients who had a decrease (improvement) of 2.6. Another predictor of satisfaction was %EBWL. Dissatisfied patients lost 52.1% EBWL compared with satisfied patients who lost 59.3%. Other possible predictors of patient satisfaction, such as complications and readmissions, were not statistically significant.

In multivariate models (Table IV), we combined dissatisfied and neutral patients and compared them with satisfied patients. We found that the change in the GERD score was the greatest single predictor of patient satisfaction, explaining 10.1% of the variation. Among patients in the bottom quintile who had the greatest worsening in GERD symptoms, variation in satisfaction was explained to a much greater extent by the change in GERD score (30.2%). Moreover, only 1.8% of variation in patient satisfaction was explained by change in %EBWL. In quintiles 2–5, both change in GERD and %EBWL only explained 2.3% of variation in patient

Table III
Predictors of patient satisfaction

	All patients	Satisfied	Neutral	Dissatisfied	P value
Total GERD score at baseline (mean)	6.99	5.72	10.43	14.66	<.0001
Total GERD score at 1-y follow-up (mean)	5.36	3.09	10.71	21.94	<.0001
Change in total GERD score (mean)	1.62	2.63	–0.29	–7.28	<.0001
% EBWL	58.25	59.26	55.51	52.08	<.0001
30-day outcomes (%)					
Serious complications	1.23	1.25	1.23	0.89	.651
Operative complications	1.92	1.81	2.11	2.97	.135
Readmissions	2.56	2.40	2.99	3.56	.099
Reoperations	0.61	0.58	0.61	0.89	.558

Table IV
Percent variation in satisfaction explained by predictors of satisfaction

	All patients	Quintile 1 (worse delta GERD)	Quintiles 2–5 (improved delta GERD)
Number of patients	6,608	1,266	5,342
Delta GERD*	10.14%	30.20%	2.26%
% EBWL*	2.43%	1.84%	2.33%
Patient characteristics	6.18%	8.65%	4.77%
Delta GERD + % EBWL	11.89%	31.05%	4.08%
Delta GERD + % EBWL + patient characteristics	16.00%	34.50%	7.47%
Other/unexplained	84.00%	65.50%	92.53%
Serious complications*	0.69%	0.63%	0.47%
Readmission	0.74%	0.84%	0.48%
Reoperation*	0.69%	0.63%	0.47%
Operative complications*	0.72%	0.69%	0.47%

* Univariate model with just covariate of interest.

satisfaction. Serious complications, readmission, reoperation, and operative complications each accounted for less than 1% of variation in satisfaction among all patients when divided among quintiles.

In Figure 1, we compared the relationship between the GERD score at baseline and the quintiles of delta GERD. We found that patients in the bottom quintile with the worst change in delta GERD had a lesser baseline GERD score than patients in the top quintile with improved delta GERD. In Figure 2, examining the relationship between the GERD score at baseline and satisfaction at 1 year, we found that dissatisfied patients had a greater baseline GERD score than neutral and satisfied patients.

Discussion

SG has emerged as the most common bariatric procedure in the United States, with 135,409 cases preformed in 2017.^{11,12} Recent data suggest that a substantial number (25.5%) of patient who undergo SG suffer from gastroesophageal reflux.⁵ The degree to

which these reflux symptoms impact patient satisfaction with the procedure is unknown. In this study, we used a validated assessment tool for symptoms of GERD to evaluate the relationship between changes in GERD symptoms after SG.⁹ Our results indicate that many patients have GERD symptoms after SG which influences their overall satisfaction markedly with the procedure. For patients with the worst postoperative GERD symptoms, it was a particularly strong driver of dissatisfaction with SG.

Although reported data are conflicting, most earlier studies have shown that patients undergoing SG have a greater rate of postoperative GERD symptoms than after Roux-en-Y gastric bypass.⁵ In the recent, randomized, clinical Swiss Multicentre Bypass or Sleeve Study trial, GERD symptoms were worse postoperatively in 31.8% of patients undergoing SG and in only 6.3% in patients undergoing Roux-en-Y gastric bypass.¹ Furthermore, the Sleeve versus Bypass randomized clinical trial found that 9.1% of patients who underwent SG experienced gastroesophageal reflux as a minor complication, with 5.8% of patients experiencing it as a major complication. No gastric bypass

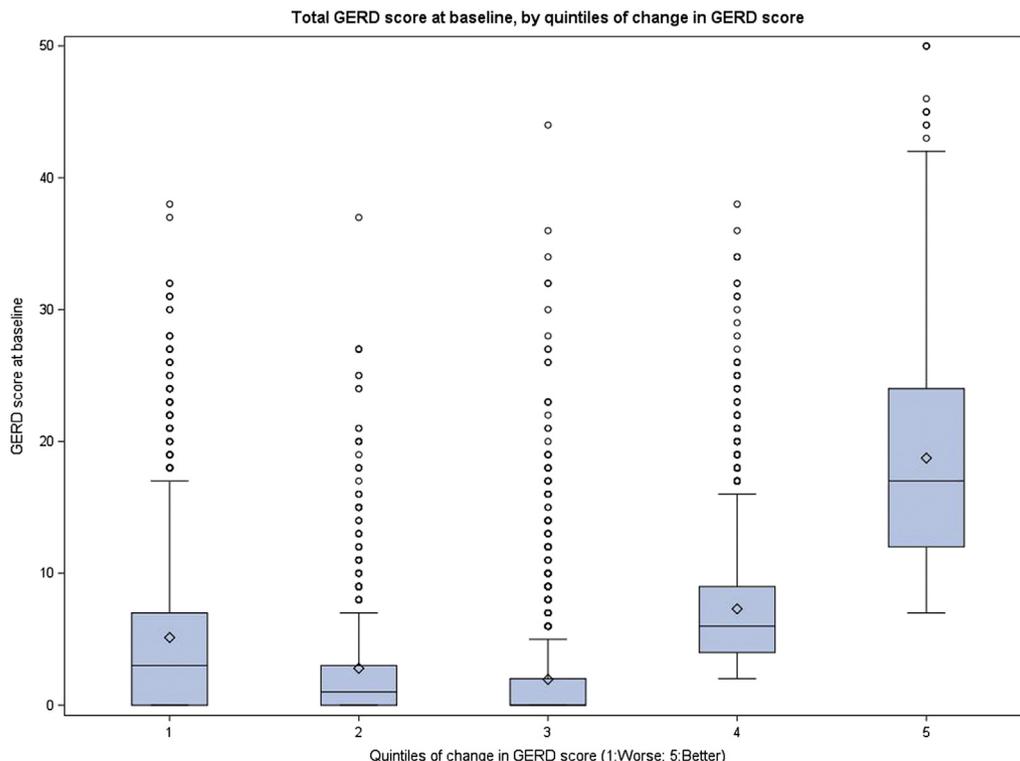


Fig 1. Total GERD score at baseline by quintiles of delta GERD.

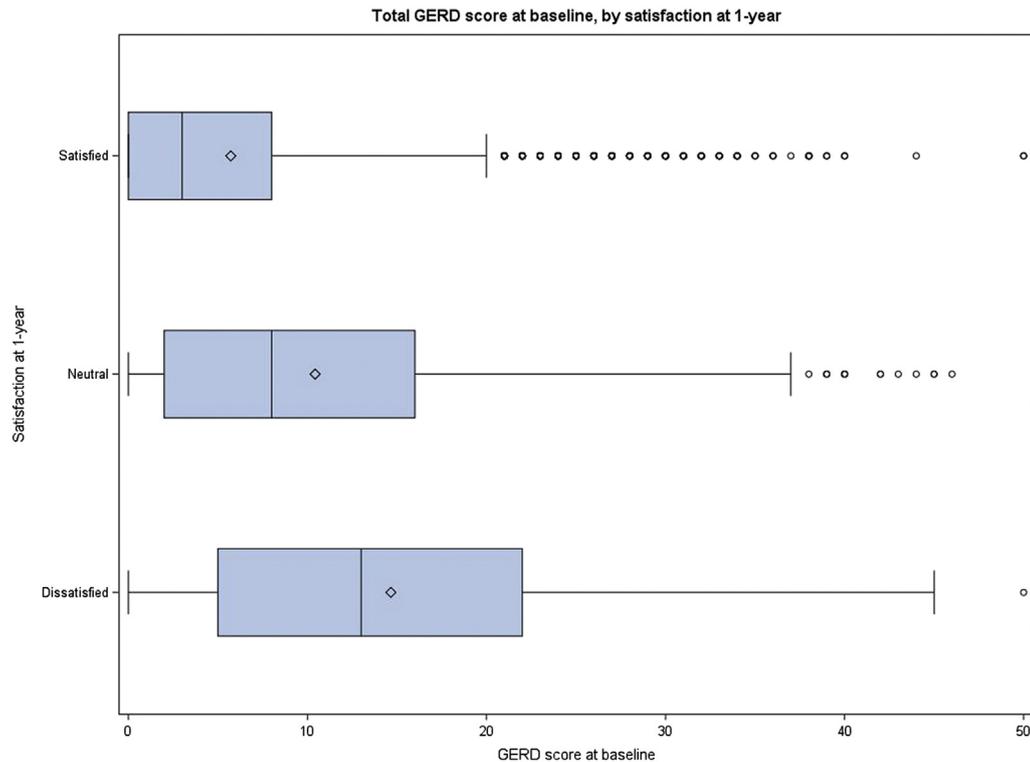


Fig 2. Total GERD score at baseline by satisfaction at 1 year.

patients had GERD complications.¹³ Our study not only evaluated the degree of GERD symptoms after SG, but also established a relationship between GERD symptoms and patient satisfaction with their procedure.

One potential limitation of this study is that it relied on patient-reported symptoms of reflux rather than on physiologic data. The gold standard for evaluating GERD is measuring the extent of mucosal damage and esophageal exposure to gastric acid using pH testing and endoscopy.¹⁴ Our study, however, was specifically designed to understand patient satisfaction that is primarily linked to patient symptoms. Moreover, earlier studies have used physiologic data to validate patient-reported symptoms.⁹ Our study may be biased in that patients who underwent SG were selected for having less-severe reflux than patients who undergo gastric bypass. Even if you consider that patients with the worst GERD are not in this study population, however, GERD remains the major driver. Our study had a response rate of 62.7% in the GERD-HRQL questionnaire and 69.3% in the satisfaction question, which could bias our findings if patients with better or worse symptoms failed to report their symptoms. Nevertheless, with more than 6,000 patients, our data represent the largest study to date on this topic.

In conclusion, our study demonstrated that gastroesophageal reflux symptoms are a primary driver of patient satisfaction with SG. These findings have implications for counseling patients on the choice of an operation when considering bariatric surgery. All patients undergoing SG should be counseled that reflux symptoms may worsen after SG, because this could affect their satisfaction with the procedure. By setting appropriate expectations preoperatively, patients can be better informed about the potential need for lifelong medical therapy or even revisional surgery if reflux symptoms are life limiting. Doing so may improve the patient experience and satisfaction with the decision-making process.

Funding/Support

This work has no funding source.

Conflict of interest/Disclosure

The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article. Dr Dimick is a cofounder of ArborMetrix, Inc., a company that makes software for profiling hospital quality and efficiency, which had no role in the work herein. Dr Varban receives salary support from Blue Cross Blue Shield of Michigan/Blue Care Network for leadership and participation in quality improvement initiatives through the Michigan Bariatric Surgery Collaborative. Van Wieren, Thumma and Dr. Obeid have nothing to disclose.

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