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Outcomes associated with preoperative weight loss after laparoscopic Roux-en-Y gastric bypass

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Abstract

Background—Laparoscopic Roux-en-Y gastric bypass (LRYGB) is an effective treatment for achieving and maintaining weight loss and for improving obesity-related comorbidities. As part of the approval process for bariatric surgery, many insurance companies require patients to have documented recent participation in a supervised weight loss program. The goal of this study was to evaluate the relationship of preoperative weight changes with outcomes following LRYGB.

Methods—A retrospective review was conducted of adult patients undergoing LRYGB between 2008 and 2012 at a single institution. Patients were stratified into quartiles based on % excess weight gain (0–4.99 % and ≥ 5 % EWG) and % excess weight loss (0–4.99 % and ≥ 5 % EWL). Generalized linear models were used to examine differences in postoperative weight outcomes at 6, 12, and 24 months. Covariates included in the final adjusted models were determined using backwards stepwise selection.

Results—Of the 300 patients included in the study, there were no significant demographic differences among the quartiles. However, there was an increased time to operation for patients who gained or lost ≥ 5 % excess body weight ($p < 0.001$). Although there was no statistical significance in postoperative complications, there was a higher rate of complications in patients with ≥ 5 % EWG compared to those with ≥ 5 % EWL (12.5 vs. 4.8 %, respectively; $p = 0.29$). Unadjusted and adjusted generalized linear models showed no statistically significant association between preoperative % excess weight change and weight loss outcomes at 24 months.

Conclusion—Patients with the greatest % preoperative excess weight change had the longest intervals from initial visit to operation. No significant differences were seen in perioperative and postoperative outcomes. This study suggests preoperative weight loss requirements may delay the time to operation without improving postoperative outcomes or weight loss.

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Compliance with ethical standards

Disclosures Drs. Camille Blackledge, Joshua Richman, Richard Stahl, and Jayleen Grams have no conflicts of interest or financial ties to disclose. Laura A. Graham and Allison A. Gullick have no conflicts of interest or financial ties to disclose.

Keywords

Obesity; Bariatric surgery; Preoperative weight loss; Outcomes; Laparoscopic Roux-en-Y gastric bypass

Obesity is a growing epidemic in the USA with over one-third of the population having a Body Mass Index (BMI) $>30 \text{ kg/m}^2$ [1]. Obesity places individuals at an increased risk for developing obesity-related comorbidities such as diabetes, hypertension, obstructive sleep apnea, osteoarthritis, stroke, cardiovascular disease, and cancer [2]. Bariatric surgery remains the most effective treatment for achieving and maintaining weight loss in patients with morbid obesity [3]. Surgery also has the benefit of improving obesity-related comorbidities [3–11].

The approval process for bariatric surgery can be an onerous task [12]. As part of the approval process for bariatric surgery, many insurance companies require patients to have documented recent participation in a 6- to 12-month supervised dietary program. These programs are often physician-supervised and require multiple strictly regimented documented visits. For example, the 6-month diet may need to be restarted if even one visit does not fall within a 30-day interval to qualify for a “monthly” evaluation. Additionally, some bariatric surgeons may require patients to lose 5–10 % of excess weight prior to surgery, usually based on a very high BMI at the initial visit in an attempt to improve the safety of the operation [13, 14]. This can be a difficult goal to achieve for a population that has failed previous attempts at weight loss. Furthermore, the relationship between preoperative weight loss attempts and postoperative outcomes remains undetermined. Various studies have documented the benefits of preoperative weight loss, while other studies have not shown a significant difference in outcomes based on preoperative weight loss [14–17]. As a result, there is no consensus on whether preoperative weight loss should be required for all patients undergoing bariatric surgery. The purpose of this study was to evaluate the association of preoperative weight loss with outcomes following Roux-en-Y gastric bypass.

Materials and methods

Study population

The study was reviewed and approved by the institutional review board. A retrospective chart review was conducted of a prospectively maintained database of all patients who underwent laparoscopic Roux-en-Y gastric bypass (LRYGB) at a single institution from January 1, 2008, to December 31, 2012. Exclusion criteria comprised age <21 years of age and patients who were lost to follow-up at <6 months. Patient data collected included demographics, presence of comorbidities (diabetes, hypertension, obstructive sleep apnea, and hyperlipidemia), operative characteristics (The American Society of Anesthesiologist (ASA) classification, operative time, and intraoperative estimated blood loss), and postoperative complications. Complications were further categorized according to the Clavien-Dindo classification [18]. Height, weight, and BMI were collected at the time of initial visit, preoperative visit (visit to schedule operation after completing all preoperative

requirements), and at each postoperative visit. Patients were stratified into quartiles according to preoperative % change in weight, calculated from weight at the initial and the preoperative visits: 0–4.99 % and ≥ 5 % excess weight gain (%EWG); and 0–4.99 and ≥ 5 % excess weight loss (%EWL). To account for nonlinear trends in weight change following LRYGB, weight at 6 months, 1 year, and 2 years postoperation was calculated by taking the weight closest to that time within a range of ± 45 days (i.e., for 1 year, the weight at the closest visit to 365 days within the range of 320 and 410 days was used).

Statistical analyses

Prior to undertaking analyses, univariate statistics for all collected variables were examined and missing information was thoroughly assessed. All weights were examined as a continuous variable as well as a categorical variable using quartiles and clinically meaningful cut points of % weight change. Locally weighted scatterplot smoothing was used to assess nonlinear trends in weight change across time. Bivariate statistics were used to examine differences in patient demographics, comorbidities, and operative characteristics by preoperative weight change defined by %EWG or %EWL as well as by postoperative weight change at 1 year after operation defined by %EWG or %EWL. Chi-square test statistics were used to examine differences among categorical variables, and Wilcoxon rank-sum tests were used to compare differences in continuous variables.

To account for nonlinear trends across time, postoperative weight change at 6 months, 1, and 2 years postoperation was examined by categories of preoperative %EWG or %EWL with the Kruskal–Wallis test used to examine differences across categories. Using a landmark analysis, the most parsimonious adjusted generalized linear models of factors associated with postoperative weight change at each time point were constructed using backwards stepwise selection at an alpha of 0.05. The final adjusted model included height, starting weight, age at operation, race, gender, diabetes history, and history of hypertension.

Finally, generalized additive models of postoperative weight change incorporating time since operation as a smoothed term were constructed using backwards stepwise selection. Using the final model, adjusted postoperative weight change was plotted across time since operation to examine the nonlinear association between postoperative weight change and time since operation. All analyses, with the exception of the smoothed scatterplots and generalized additive models, were completed using SAS v9.4. Smoothed scatterplots were constructed using the R package GGPlot2 [19], and the R package MGCV [20, 21] was used to construct the generalized additive models for the adjusted postoperative weights across time. An alpha of 0.05 was considered statistically significant.

Results

A total of 323 patients who met inclusion criteria underwent LRYGB from January 1, 2008, to December 31, 2012. There were 23 patients who were lost to follow-up prior to their 6-month postoperative visit and were excluded from analyses. Of the remaining 300 patients, 75 % of the patients were female with a median age of 44 years (interquartile range 37–52) (Table 1). In the four quartiles, 26.7 % of the patients had ≥ 5 % EWG, 39.3 % had 0–4.99 % EWG, 20.0 % had 0–4.99 % EWL, and 14.0 % had ≥ 5 % EWL. There were no significant

differences in age, sex, race, or comorbidities among the groups. However, there was a significant difference in time to operation across all groups ($p < 0.001$), with patients who gained or lost 5 % excess body weight having the longest intervals (251 and 267 days, respectively). At the initial visit, there was a trend toward a difference in weight among the groups with the patients who had preoperative %EWL having a higher initial weight than patients who had preoperative %EWG, but it did not reach statistical significance ($p = 0.05$) (Table 1). There was no difference among the groups in BMI at the initial visit ($p = 0.07$). By the time of the preoperative visit, preoperative weight was similar among all groups ($p = 0.23$) and there remained no significant difference in BMI ($p = 0.24$).

Regarding operative characteristics, the American Society of Anesthesiologists (ASA) classification was similar across all groups, and the majority of the patients were ASA classification 3 (82.9 %) (Table 2). There was no significant difference in operative time or estimated blood loss (EBL), although EBL data were missing for 19.0 % of patients. As seen in Table 3, patients with 5 % EWG had a higher rate of postoperative complications than those with 5 % EWL (12.5 vs. 4.8 %, respectively). However, there were no statistically significant differences among the groups ($p = 0.29$). There was no 90-day surgical mortality.

Unadjusted generalized linear models showed no statistically significant difference among postoperative weight loss outcomes at 6, 12, or 24 months based on preoperative % excess weight change (data not shown). After adjusting for age, sex, race, height, presence of diabetes and hypertension, and initial weight, there remained no association between postoperative weight loss outcomes and preoperative % excess weight change at any postoperative time interval (Table 4). To account for all postoperative visits, generalized linear models were constructed comparing postoperative %EWL stratified by preoperative % excess weight change (Fig. 1). There was no significant difference in postoperative weight loss outcomes among groups in either unadjusted or adjusted analysis.

Discussion

This study examined the outcomes associated with preoperative weight changes in bariatric surgery. The patients with the greatest preoperative weight change had a statistically significant delay in the time from their initial bariatric clinic visit to operation. There was no statistically significant association between preoperative percent excess weight change and postoperative complications or weight loss outcomes. These results suggest there may be no benefit in the requirement of preoperative weight loss in preparation for bariatric surgery.

Many insurance companies require strict documentation of a recent supervised weight loss program ranging in duration from 3 to 12 months before approving coverage for bariatric surgery [12]. There is no requirement that a specified amount of weight loss be achieved, only that a supervised recent attempt at weight loss is documented prior to approval for bariatric surgery. It must be emphasized that this mandate is in a population of patients, (1) who have morbid obesity and weigh at least approximately 100 pounds more than their ideal weight, (2) who commonly have struggled with their weight and/or obesity their entire lives, and (3) who are unlikely to achieve significant and durable weight loss through diet and exercise alone. Our results do not support these mandates from a patient-centered standpoint,

showing comparable outcomes in complications and postoperative weight loss despite varying preoperative weight changes in the months preceding operation. Other studies support that there is no benefit to patients in insurance-mandated supervised weight loss efforts before bariatric surgery and that these mandates may result in greater attrition, significant delays in time to operation, and weight gain during this interval [22–24]. Thus, these policies do not provide any value to the patient or medical system in their care and may in fact represent a barrier to care and be detrimental.

Motivated by the efforts to decrease surgical risk, many surgeons and bariatric programs do not specify a defined time interval but do require preoperative weight loss. In our practice, we selectively require preoperative weight loss based on BMI at the initial visit. This is the likely reason that the patients with greatest %EWL had a higher initial visit weight and BMI than the patients with greatest %EWG. Although not significant, our data did show a lower rate of complications in patients with the greatest %EWL versus greatest %EWG. This would be consistent with prior studies demonstrating a lower complication rate in patients who had preoperative weight loss [25–28]. The largest study to date from the Scandinavian Obesity Registry (SOREg) included 22,327 patients who underwent RYGB and demonstrated that preoperative weight loss was associated with reduction in risk of postoperative complications, with reduction more marked with greater weight loss. Additionally, although there was decreased risk of complications with greatest weight loss across all BMI categories, patients in the highest BMI category may be the most likely to benefit from preoperative weight reduction [28].

A number of meta-analyses have shown mixed results in postoperative weight loss outcomes based on preoperative weight loss [14–17]. Differences in study design, selection bias in who must achieve preoperative weight loss, amount of preoperative weight loss to be achieved, and differences in reporting postoperative weight loss outcomes all likely contribute to the lack of consensus. As a result, existing data do not support the denial of bariatric surgery based solely on meeting arbitrary preoperative weight loss mandates. Our results support that bariatric surgery should not be withheld from patients based on inability to meet preoperative weight loss requirements alone, since there was no significant difference in weight loss outcomes at any time interval based on preoperative weight change. Frank discussion between the surgeon and patient must consider a number of factors in determining how to proceed: (1) initial versus preoperative BMI and risk of complications, (2) reasons for failure to lose weight, such as ongoing poor eating habits or lack of identification of and participation in dedicated activity, and (3) overall impact of obesity on the patient's health and quality of life.

Limitations of this study include that it is a retrospective study based on a prospectively maintained database. We could not determine which patients needed to complete an insurance-mandated preoperative weight loss program and/or to achieve preoperative weight loss as required by the surgeon. The attrition rate was not determined. Finally, there was a low complication rate, so that the study would be underpowered to detect a significant association between preoperative weight change and complications. Further research should examine the individual influence of insurance-mandated weight loss programs and subsequent weight loss outcomes.

In conclusion, patients with the greatest preoperative weight changes had the longest interval from initial visit to operation. Although there were more complications in the greatest %EWG group, there were no significant differences in perioperative or postoperative outcomes based on preoperative weight change. This study suggests that preoperative weight loss requirements may delay the time to operation without improving postoperative outcomes.

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Fig. 1. Unadjusted (**A**) and adjusted (**B**) postoperative %EWL stratified by preoperative weight change. %EWL, % excess weight loss

Table 1

Patient demographics

	Overall	Preoperative %EWG ^a		Preoperative %EWL		p value [*]
		5	0–4.99	0–4.99	5	
Number	300	80 (26.7 %)	118 (39.3 %)	60 (20.0 %)	42 (14.0 %)	
Age, years	44 (37–52)	45 (37–54)	42 (37–50)	46 (41–53)	43 (37–51)	0.21
Sex						
Male	75 (25.0 %)	21 (26.3 %)	25 (21.2 %)	13 (21.7 %)	16 (38.1 %)	0.16
Female	225 (75.0 %)	59 (73.8 %)	93 (78.8 %)	47 (78.3 %)	26 (61.9 %)	
Race						
European American	206 (68.7 %)	54 (67.5 %)	78 (66.1 %)	42 (70.0 %)	32 (76.2 %)	0.67
African American	94 (31.3 %)	26 (32.5 %)	40 (33.9 %)	18 (30.0 %)	10 (23.8 %)	
Comorbidities						
T2DM	126 (42.6 %)	31 (39.2 %)	45 (38.5 %)	28 (48.3 %)	22 (52.4 %)	0.31
HTN	217 (72.8 %)	56 (71.8 %)	82 (69.5 %)	45 (75.0 %)	34 (81.0 %)	0.52
OSA	191 (64.3 %)	50 (63.3 %)	74 (63.3 %)	37 (62.7 %)	30 (71.4 %)	0.78
Hypertlipidemia	95 (33.8 %)	19 (26.8 %)	46 (42.2 %)	19 (32.2 %)	11 (26.2 %)	0.10
Initial visit						
Time to operation (days)	199.5 (124–316)	251 (170–382)	168 (110–274)	150 (92–241)	267 (169–382)	<0.001
Initial weight (lbs)	290.8 (262–333)	286 (262–325)	286 (254–327)	308 (275–339)	304 (269–363)	0.05
Initial BMI (kg/m ²)	47.3 (43.4–53.1)	46.5 (43.3–50.6)	47.3 (43.1–53.1)	49.3 (45–54.4)	47.9 (43.4–59.4)	0.07
Preoperative visit						
Time to operation (days)	16 (7–32)	12 (5–19)	19 (11–82)	12 (5–23)	18 (5–26)	0.01
Preoperative weight (lbs)	296.5 (263–335)	302 (271–339)	287 (258–332)	303 (271–335)	292 (254–335)	0.23
Preoperative BMI (kg/m ²)	48.1 (44.0–53.3)	49.1 (45.2–53.5)	47.8 (43.8–53.2)	48.7 (44.7–53.8)	45.3 (41.7–53.2)	0.24

Data represented as number (%) or median (interquartile range)

^a% EWG, % excess weight gain; % EWL, % excess weight loss; T2DM type 2 diabetes mellitus, HTN hypertension, OSA obstructive sleep apnea, BMI/body mass index^{*} p value <0.05 is significant

Table 2

Operative characteristics

	Overall	Preoperative %EWG ^a		Preoperative %EWL		<i>p</i> value [*]
		5	0–4.99	0–4.99	5	
Number	300	80 (26.7 %)	118 (39.3 %)	60 (20.0 %)	42 (14.0 %)	
ASA classification						
2	47 (15.7 %)	15 (18.8 %)	20 (17.1 %)	7 (11.7 %)	5 (11.9 %)	0.77
3	248 (82.9 %)	64 (80 %)	95 (81.2 %)	53 (88.3 %)	36 (85.7 %)	
4	4 (1.3 %)	1 (1.3 %)	2 (1.7 %)	0 (0.0 %)	1 (2.4 %)	
Operative time (min)	129 (107–178)	145 (107–183)	120 (103–167)	135 (109–188)	142 (107–178)	0.23
EBL (mL)						
<25	133 (44.3 %)	37 (46.3 %)	52 (44.1 %)	23 (38.3 %)	21 (50.0 %)	0.48
25–50	44 (14.7 %)	10 (12.5 %)	21 (17.8 %)	8 (13.3 %)	5 (1.9 %)	
50–75	40 (13.3 %)	11 (13.8 %)	15 (12.7 %)	6 (10.0 %)	8 (19.1 %)	
>75	26 (8.7 %)	10 (12.5 %)	6 (5.1 %)	8 (13.3 %)	2 (4.8 %)	
Missing	57 (19.0 %)	12 (15 %)	24 (20.3 %)	15 (25.0 %)	6 (14.3 %)	

Data represented as number (%) or median (interquartile range)

^a%EWG, % excess weight gain; %EWL, % excess weight loss; ASA American Society of Anesthesiologists, EBL estimated blood loss^{*}*p* value <0.05 is significant

Table 3

Complications

	Overall	Preoperative %EWG ^a		Preoperative %EWL		<i>p</i> value [*]
		5	0-4.99	0-4.99	5	
Any complication	23 (7.7 %)	10 (12.5 %)	7 (5.9 %)	4 (6.7 %)	2 (4.8 %)	0.29
Complication grade ^b						
I	1 (0.3 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	1 (2.4 %)	0.28
II	5 (1.7 %)	2 (2.5 %)	3 (2.5 %)	0 (0.0 %)	0 (0.0 %)	
IIIa	11 (3.7 %)	5 (6.3 %)	2 (1.7 %)	3 (5.0 %)	1 (2.4 %)	
IIIb	6 (2.0 %)	3 (3.8 %)	2 (1.7 %)	1 (1.7 %)	0 (0.0 %)	

Data represented as number (%)

^a %EWG, % excess weight gain; %EWL, % excess weight loss^b Based on Clavien-Dindo classification of surgical complications¹⁸^{*} *p* value <0.05 is significant

Table 4

Adjusted postoperative %EWL stratified by preoperative weight change

Follow-up interval, months	Preoperative % excess weight change	Postoperative %EWL ^a	<i>p</i> value*
6	Gain 5 %	49.3 (46.8–51.8)	0.17
	Gain 0–4.99 %	52.3 (50.2–54.4)	
	Loss 0–4.99 %	51.8 (49.0–54.6)	
	Loss 5 %	51.9 (48.7–55.0)	
12	Gain 5 %	62.5 (58.5–66.6)	0.16
	Gain 0–4.99 %	65.5 (62.1–68.8)	
	Loss 0–4.99 %	60.7 (56.4–65.1)	
	Loss 5 %	65.4 (60.0–70.7)	
24	Gain 5 %	68.7 (61.1–76.3)	0.41
	Gain 0–4.99 %	64.1 (57.8–70.4)	
	Loss 0–4.99 %	61.4 (53.9–68.8)	
	Loss 5 %	69.4 (57.9–80.9)	

Adjusted for age, sex, race, height, presence of diabetes and hypertension, and initial weight %EWL, % excess weight loss

^aData represented as mean (95 % CI)*
p value <0.05 is significant