Journal of Gastrointestinal Surgery (2022) 26:86–93
https://doi.org/10.1007/s11605-021-05055-5

ORIGINAL ARTICLE

Preoperative Weight Loss as a Predictor of Bariatric Surgery Postoperative Weight Loss and Complications

Jamil S. Samaan[1] · Jasmine Zhao[2] · Elaine Qian[2] · Angelica Hernandez[2] · Omar Toubat[2] · Evan T. Alicuben[2] · Yousaf Malik[2] · Kulmeet Sandhu[2] · Adrian Dobrowolsky[2] · Kamran Samakar[2]

Received: 25 November 2020 / Accepted: 22 May 2021 / Published online: 18 June 2021

Abstract

Background The association between preoperative weight loss and bariatric surgery outcomes remains unclear. We explored the utility of preoperative weight loss as a predictor of postoperative weight loss success. Additionally, we examined the association of preoperative weight loss with perioperative complication rates.

Methods Retrospective chart review of patients who underwent primary sleeve gastrectomy or primary Roux-en-Y gastric bypass for weight loss at a single institution between January 2003 and November 2017. Additional follow-up was obtained by a postoperative standardized patient questionnaire. Statistical analysis consisted of bivariate and multivariate logistic regression analysis.

Results Our study included 427 patients. Majority were female (n = 313, 73.3%) and underwent sleeve gastrectomy (n = 261, 61.1%). Average age was 45.6 years, and average follow-up was 6.3 years. Greater preoperative weight loss was associated with decreased length of stay (1.8 vs 1.3 days) in patients who underwent sleeve gastrectomy. Multivariable regression analysis revealed that preoperative weight loss was not associated with postoperative weight loss.

Conclusions Preoperative weight loss is not predictive of postoperative weight loss success after bariatric surgery. Greater preoperative weight loss was associated with a mild decreased in length of stay but was not associated with a reduction in operative time, overall complication rates, ICU admissions, or intraoperative complications. The inconclusive literature and our findings do not support the medical necessity of weight loss prior to bariatric surgery for the purpose of reducing surgical complications or predicting successful postoperative weight loss success.

Keywords Preoperative weight loss · Postoperative weight loss · Bariatric surgery · Surgical complications

✉ Kamran Samakar
kamran.samakar@med.usc.edu

Jamil S. Samaan
jamil.samaan@gmail.com

Jasmine Zhao
zhaojasm@usc.edu

Elaine Qian
emqian24@gmail.com

Angelica Hernandez
abhernandez167@gmail.com

Omar Toubat
toubat@usc.edu

Evan T. Alicuben
alicuben@gmail.com

Yousaf Malik
ymalikba@gmail.com

Kulmeet Sandhu
kulmeet.sandhu@med.usc.edu

Adrian Dobrowolsky
adrian.dobrowolsky@med.usc.edu

[1] Department of Medicine, Cedars Sinai Medical Center, 8700 Beverly Blvd., Los Angeles, CA 90048, USA

[2] Division of Upper GI & General Surgery, Department of Surgery, Keck School of Medicine of the University of Southern California, 1510 San Pablo St, Suite 51, Los Angeles, CA 90033, USA

Introduction

Obesity is a growing national epidemic that currently affects 40% of adults in the USA.[1] Globally, obesity accounts for approximately 4 million deaths and represents 7.1% of all-cause mortality.[2] Multiple disease processes are closely associated with obesity, including high blood pressure, high cholesterol, and type 2 diabetes mellitus. These conditions not only contribute to the comorbidity burden in obese patients, but also serve as major risk factors for cardiovascular disease.[3, 4] Additionally, obesity is associated with a reduced health-related quality-of-life, functional limitations, and poor mental health.[5]

Bariatric surgery has been shown to be a highly effective long-term weight loss intervention with laparoscopic Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG) being the most common procedures employed.[6–8] In addition to facilitating weight loss, a meta-analysis by Buchwald et al. in 2005 reported that bariatric surgical interventions may also contribute to a resolution of type 2 diabetes, hypertension, and sleep apnea in a majority of patients with these comorbidities.[9] Moreover, due to advances in laparoscopic techniques, bariatric surgery has become a relatively safe procedure, with a mortality rate of less than 1% across studies.[10, 11] However, despite the clear benefits of surgery, previous studies have shown that less than 1% of patients who are clinically eligible to undergo bariatric surgery do so[12] Although the reasons for this are not completely understood, a possible contributing factor is the requirement for patients to adhere to strict weight loss programs or meet specific weight loss criteria before qualifying for surgery.[13, 14]

Preoperative weight loss (PreWL) has previously been studied as a predictive factor for success of postoperative outcomes after bariatric surgery.[15–17] While the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program recommends PreWL as a tool for optimizing comorbidities in certain patient populations, these recommendations are based on limited evidence suggesting that increased PreWL may result in a greater reduction in surgical complications.[18] For instance, it has been suggested that laparoscopic surgery may be more challenging in an obese patient due to limited visualization of the abdomen and difficulty in manipulation of surgical instruments. Obese patients also have a greater prevalence of enlarged nonalcoholic fatty liver, which may contribute to increased conversions to open surgery.[19, 20] Some proponents of PreWL have asserted that it may decrease liver size and lead to a reduction in surgical complications, operative time, and morbidity in patients undergoing bariatric surgery.

The existing literature has shown mixed results on the effects of PreWL on postoperative weight loss outcomes and complication rates. A recent review by Tewksbury et al. found that PreWL may not be the strongest predictor of postoperative weight loss.[21] In addition, the variability of results from published studies makes it challenging to clearly recommend for or against the use of PreWL requirements for surgical eligibility. This is supported by a recent review by Kim et al., who concluded that there is insufficient evidence regarding the benefits of mandatory PreWL on postsurgical outcomes.[13] Therefore, the practice of mandating preoperative weight loss prior to bariatric surgery is controversial according to available literature and may be a potential obstacle for patients requiring surgical treatment for obesity.

While most patients experience significant and persistent weight loss after bariatric surgery, as many as 20% of patients may experience postoperative weight regain.[22] Several studies have attempted to correlate preoperative characteristics with bariatric surgical outcomes, but the factors associated with long-term bariatric surgical success remain unclear. The objective of this study is to evaluate the impact of PreWL on perioperative complication rates and postoperative weight loss (PostWL) for patients who underwent bariatric surgery for obesity at our institution.

Materials and Methods

This was a single-center, multi-surgeon, retrospective study of patients who underwent primary laparoscopic sleeve gastrectomy (LSG) or primary laparoscopic Roux-en-Y gastric bypass (LRYGB) surgery for obesity at our institution between January 2003 and November 2017. Data collection utilized chart review and a postoperative standardized patient questionnaire for follow-up. A total of 54.9% (234/426) of postoperative follow-up weight were obtained by telephone follow-up. This study was approved by the Institutional Review Board of the University of Southern California.

Date of initial evaluation for bariatric surgery and operative date were used to calculate length of bariatric program (LOBP). Preoperative weight loss (PreWL) was calculated using preoperative excess weight and initial evaluation excess weight. Only patients with a LOBP of 90 days or greater were included in our analysis. Height was used to calculate ideal BMI and subsequently excess weight. PostWL success was defined as greater than 50% excess weight loss (%EWL) at least 1 year after surgery.

Statistical Analysis

Categorical variables are reported as frequencies and percentages, while continuous variables are reported as means with 95% confidence intervals. Patients who underwent any additional procedures during their surgery were excluded from analysis regarding perioperative complications. Bivariate analysis was used to compare between patients who achieved EWL greater than 10% and patients who achieved EWL less

than 10% for each surgery. Analysis included Chi-square and Fisher's exact test for categorical variables and Student's *t* test for continuous variables.

Multivariable logistical regression models were constructed to examine PreWL as a predictive factor for PostWL. Patients were organized into three groups based on preWL during bariatric program: (1) patients who achieved less than 5 %EWL (%EWL < 5); (2) patients who achieve greater than 5 %EWL but less than 10 %EWL (5 < %EWL < 10); and (3) patients who achieve greater than 10 %EWL (%EWL > 10) similar to a previously published report.[15] Covariates included in the regression model were age, sex, surgery type, preoperative BMI, length of postoperative follow-up, and LOBP. Covariates were chosen based on clinical relevance and maximizing model fit. Univariate logistical regression was first used to determine the unadjusted effect of each covariate. A multivariable logistical regression model which included all variables to examine how these predictors changed when adjusting for covariates was then constructed. Linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure, and all continuous variables were found to be linearly correlated to the logit of the dependent variable. All models were statistically significant. Model fit was assessed using Hosmer and Lemeshow test. For all statistical analyses, a p value of less than 0.05 was considered significant. All analysis was performed using IBM SPSS statistics 24 software.

Table 1 Summary of patient demographics, past medical history, and past surgical history

	N	%	Mean [95% CI]
Age			45.6 [44.5–46.7]
Sex			
Female	312	73.2	
Male	114	26.8	
Surgery type			
Sleeve gastrectomy	260	61.0	
Roux-en-Y gastric bypass	166	39.0	
Hypertension	232	54.5	
Number of medications			1.5 [1.4–1.6]
Diabetes	125	29.3	
Number of medications			1.8 [1.6–2.0]
Preoperative insulin use	44	35.2	
Hyperlipidemia	139	32.6	
Number of medications			0.8 [0.7–0.9]
Osteoarthritis	197	46.2	
OSA[a]	154	36.2	
CPAP[b] use	64	41.6	
GERD[c]	207	48.5	
History of abdominal surgery	195	46.3	
History of foregut surgery	52	12.6	

[a] *OSA* obstructive sleep apnea; [b] *CPAP* continuous positive airway pressure; [c] *GERD* gastroesophageal reflux disease

Results

A total of 426 patients were included in our analysis. The majority was female (n = 312, 73.2%) and underwent LSG (n = 201, 61.0%). The average age at surgery was 45.6 years, and the average length of follow-up was 6.3 years. The most common comorbidities included hypertension (54.5%), GERD (48.5%), and osteoarthritis (46.2%). Summary of patient demographics, past medical history, and past surgical history is shown in Table 1. Patients presented with an average BMI of 47.3 at initial evaluation for bariatric surgery. The average LOBP was 32.7 weeks, during which patients achieved an average of 9.7 %EWL. When categorized by PreWL during LOBP, 30% of patient achieved less than 5% %EWL, 16% achieved greater than 5% but less than 10%, and 54% achieved greater than 10% %EWL as shown in Fig. 1. Postoperatively, patients lost an average of 57.9 %EWL, and 59.8% achieved PostWL success. Summary of preoperative and postoperative data is shown in Table 2.

Perioperative complication rates for patients who achieved less than and greater than 10 %EWL are compared (Table 3). Intraoperative complications, estimated blood loss, transfusion requirement, operative time, postoperative complications, and ICU admissions were not significantly associated with PreWL for either surgery type. Greater than 10 %EWL was associated with lower length of stay (LOS) (1.3 vs 1.8) in patients who underwent SG but not RYGB.

We evaluated the association between PreWL and PostWL success. Univariate analysis revealed patients who achieved greater than 5%, and less than 10 %EWL preoperatively were O.R. 0.41 (95%CI: 0.20–0.86) as likely to achieve PostWL compared to patients who achieved less than 5 %EWL. Patients who achieved greater than 10 %EWL preoperatively were O.R. 0.54 (95%CI: 0.31–0.94) times as likely to achieve PostWL as patients who achieved less than 5 %EWL. A multivariableregression analysis was then conducted in order to adjust for sex, age, surgery type, length of postoperative follow-up, length of bariatric program, and preoperative BMI. We find no significant association between PreWL and PostWL success (Table 4).

Discussion

Bariatric surgery has been proven to be an effective modality for long-term weight loss and comorbidity resolution. PreWL is commonly mandated for patients prior to bariatric surgery despite the lack of consensus in the literature regarding its

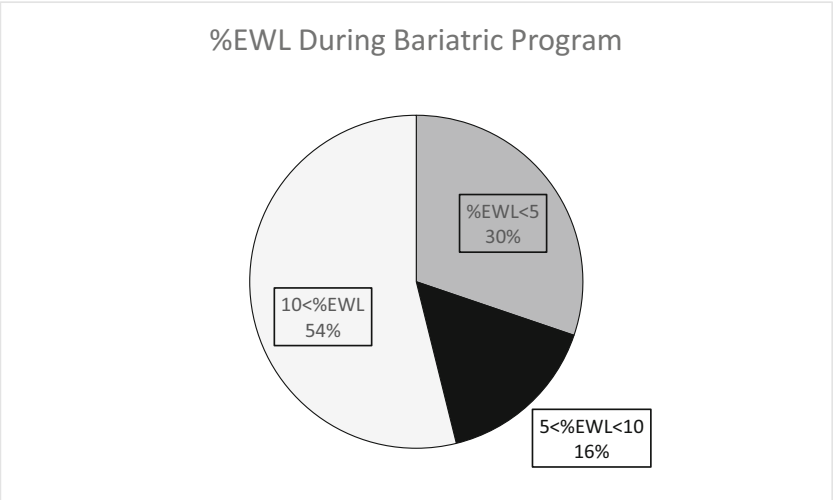

Fig. 1 Distribution of patients according to preoperative percent excess weight loss (%EWL) during bariatric program

benefits. We examined the association of PreWL with perioperative complications and PostWL after bariatric surgery. We conducted a rigorous analysis and fairly stringent data requirement for our cohort including at least 90 days of LOBP for all patients. Analysis of PreWL association with PostWL included patients with at least 1-year follow-up, which resulted in a relatively long average follow-up (6.3 years) compared to other studies and analysis utilized a multivariable logistical regression model to control for possible confounding variables. Additionally, we excluded patients with concomitant procedures during surgery for analysis of complications in order to limit operative variability. We found no significant association between PreWL and perioperative complications or PostWL.

While it may be intuitive that patients who lose weight prior to surgery will likely be more successful in achieving postoperative weight loss, data from published studies on this topic have been conflicting and inconsistent. Some reports demonstrate a positive association,[23–25] while others find no association.[15, 26–29] In 2015, Gerber et al. published a study that summarized data from two randomized controlled trials, 21 prospective or retrospective studies, and reviews by Livhitset al. and Oncher et al. to comprehensively study the effects PreWL on surgical complications and PostWL.[30–32] The authors concluded that due to the inconsistency of available data, the results cannot be used as justification for mandatory weight loss programs prior to bariatric surgery.[30] Our findings echo the conclusions of this review as our multivariable regression model showed no association between PreWL and PostWL. Our findings also highlight an important implication regarding statistical analysis as we found a significant correlation between PreWL and PostWL on univariate analysis as shown in Table 4. When controlling for various factors that may influence postoperative weight loss such as age, sex, preoperative BMI, and time from initial evaluation to surgery, that difference was no longer significant. These results highlight the need for strong statistical analysis such as regressions in future studies for the examination of this relationship as PostWL is a complex outcome that may be influenced by many factors.

Table 2 Summary of preoperative and postoperative data

	Frequency	Percentage	Mean [95% CI]
Preoperative data			
BMI at initial evaluation			47.3 [46.5–48.2]
Preoperative BMI			45.1 [44.3–45.9]
[a]LOBP (wks)			32.7 [30.1–35.3]
Preoperative [b]%EWL			9.7 [8.5-10.9]
Postoperative data			
Postoperative %EWL			57.9 [54.1–61.7]
BMI points lost			11.2 [10.4–12.1]
Achieved postoperative weight loss success	168	59.8	
Follow up (yrs)			6.3 [5.8–6.9]

[a] *LOBP* length of bariatric program; [b] *%EWL* percent excess weight loss

Table 3 Comparison of the differences in demographics, past medical history, past surgical history, and perioperative complication rates for patients who achieved less than or more than 10% excess weight loss (%EWL) preoperatively

	Roux-en-Y gastric bypass			Sleeve gastrectomy		
	%EWL < 10	%EWL > 10	P	%EWL < 10	%EWL > 10	P
Demographics, past medical history, and past surgical history						
Average age	44.2	43.6	0.37	43.2	45.9	0.53
Female sex (%)	56 (80.0)	45 (70.3)	19.4	14 (19.7)	49 (41.9)	< 0.01
Diabetes mellitus (%)	21 (30.0)	22 (34.4)	0.59	13 (18.3)	41 (35.0)	0.02
Hypertension (%)	43 (61.4)	37 (57.8)	0.67	29 (40.8)	64 (54.7)	0.07
Hyperlipidemia (%)	28 (40.0)	21 (32.8)	0.39	16 (22.5)	44 (37.6)	0.03
Abdominal surgery (%)	29 (41.4)	27 (42.2)	0.93	28 (41.8)	44 (37.9)	0.61
Foregut surgery (%)	6 (8.6)	7 (10.9)	0.64	9 (13.4)	12 (11.0)	0.63
Average preop BMI	45.3	43.9	0.95	45.7	44.6	0.84
Complication rates						
Intraoperative complications	0 (0)	0 (0)	--	0 (0)	0 (0)	--
Estimated blood loss ≥ 100 cc	10 (14.3)	4 (6.5)	0.17	3 (4.2)	1 (0.9)	0.15
Intraoperative transfusions	0 (0)	0 (0)	--	0 (0)	0 (0)	--
Pperative time (h)	3.08	3.15	0.22	2.02	1.98	0.80
Perioperative complications	6 (8.6)	8 (12.5)	0.46	5 (7.0)	5 (4.3)	0.51
Length of stay (days)	1.9	1.7	0.75	1.8	1.3	< 0.01
ICU admission	3 (4.3)	2 (3.1)	0.72	3 (4.2)	1 (0.9)	0.15
Hospitalization transfusions	2 (2.9)	0 (0)	0.50	0 (0)	2 (1.7)	0.53

PreWL has also been studied as a predictive factor for surgical complications. Intraoperative and postoperative complications following bariatrics surgery include anastomotic leaks, gastrointestinal bleeding, marginal ulcers, intestinal obstruction, anastomotic strictures, and deep venous thrombosis.[33–35] It is hypothesized that PreWL may help to

Table 4 Univariate and multivariablelogistical regression analysis examining the association between PreWL and PostWLS

	Univariate regression				Multivariate regression			
	95% C.I.				95% C.I.			
	OR	Lower	Upper	P	OR	Lower	Upper	P
Age	0.97	0.95	0.99	0.02	0.97	0.94	0.99	< 0.01
Female sex	2.16	1.26	3.70	< 0.01	1.88	1.04	3.35	0.04
Undergoing SG	2.54	1.56	4.15	< 0.01	0.80	0.38	1.71	0.57
Increasing preop BMI	0.98	0.95	1.00	0.10	0.96	0.93	0.99	0.01
LOBP	1.00	0.99	1.00	0.82	1.00	0.99	1.00	0.79
Increasing follow up	1.12	1.06	1.18	< 0.01	1.10	1.00	1.19	0.04
%EWL < 5 vs.								
5 < %EWL < 10	0.41	0.20	0.86	0.02	0.50	0.21	1.06	0.07
%EWL > 10	0.54	0.31	0.94	0.03	0.77	0.41	1.42	0.39
%EWL > 10 vs.								
%EWL < 5	1.85	1.07	3.19	0.03	1.31	0.71	2.42	0.40
5 < %EWL < 10	0.75	0.37	1.50	0.42	0.62	0.30	1.31	0.21

LOBP length of bariatric program

Patients were divided into three groups based on preoperative percent excess weight loss (%EWL). Covariates included in the multivariable regression model were age, sex, surgery type, preoperative BMI, length of postoperative follow-up, and LOBP (n = 281)

reduce the frequency of intraoperative complications by decreasing liver size, visceral fat, and postoperative complication rates.[36] However, current literature on postoperative complications has mixed findings with some studies showing no difference in complication rates,[14, 23, 24, 31, 37, 38] while others have identified a decreased overall complication rate in those with greater PreWL.[16, 39] Similarly, there is no correlation between PreWL and intraoperative complication rates, excess blood loss, or required transfusions, in either RYGB or SG patients. While the current inconsistency in the literature does not warrant mandatory PreWL for bariatric surgery, clinicians are encouraged to counsel patients regarding weight loss prior to surgery in order to optimize preexisting conditions that are common in this patient population.[18]

We found no association between PreWL and length of operative time. Our analysis excluded all patients who underwent additional procedures during surgery as that may significantly increase variability in operative time. A randomized clinical trial consisting of 61 patients by Alami et al. found decreased operative time with increased PreWL.[23] A relatively larger randomized multi-center clinical trial consisting of 294 patients conducted by Van Nieuwenhove found no association.[40] The authors suggest that this lack of difference may be due to differences in surgical expertise. More experienced surgeons in laparoscopic bariatric surgery are able to perform the procedures faster regardless of limited visibility of the abdominal landmarks. This hypothesis is applicable to our institution and could be an explanation for the lack of significance between PreWL and operative time.

LOS is a common parameter used as an indirect measure of surgical complications and morbidity. Some studies have reported a decreased LOS after greater PreWL,[37, 41] including one study which showed lower length of stay in patients who lost 5 to 10% of excess body weight in high-risk obese patients.[39] Other studies, including a randomized clinical trial by Alami et al., where patients were randomized to a 10% weight loss requirement or no weight loss requirement, found no difference in LOS.[14, 20, 23, 42, 43] Our data shows a significant association between increased PreWL and decreased LOS in patients who underwent SG but not RYGB. While statistically significant, the difference between 1.8 and 1.3 days may be clinically insignificant.

Due to the lack of consensus regarding the efficacy of PreWL as a predictive factor of PostWL and complication rates, further studies are necessary to make definitive conclusions. A study by Sadhasivam and colleagues found that a large percentage of patients at their institution were denied surgery despite being deemed good surgical candidates.[44] They found that failure to achieve substantial weight loss prior to surgery to be one of the reasons insurance companies denied coverage of bariatric surgery to eligible surgical candidates. While PreWL may be a positive and productive recommendation for patients with obesity, the existing data do not support withholding surgical intervention purely for failure to adequately lose weight prior to surgery. Insurers who mandate that patients participate in medical weight management programs without providing sufficient coverage for these services may be limiting access rather than improving patient outcomes. Clarifying the role of PreWL in bariatric surgery is essential not only for identifying potentially modifiable factors that can maximize postoperative success, but also for guiding clinicians and insurers in providing access to this highly effective weight loss treatment.

Our study has limitations inherent to its design being a retrospective single-center study. In addition, patient weight obtained through telephone follow-up is subject to external bias that may limit the strength of the conclusions derived from our analysis, such as social desirability bias. In order to potentially reduce risk of bias, patients were provided with a mission statement prior to every survey addressing judgment, anonymity, and the study objectives. Nevertheless, the risk for bias must be considered. The lack of association of preoperative weight loss and perioperative complications in our analysis may be due to insufficient power of our study and relatively low rates of complications. Nonetheless, we included this analysis in order to comprehensively understand the utility of preoperative weight loss. A major strength is that our study presents data on long-term postoperative outcomes (mean 6.3 years) compared to the literature. In addition, regression analysis provides a strong statistical tool for evaluating predictors of postoperative weight loss while controlling for potential confounding factors.

Future studies are needed to better understand the effect of preoperative weight loss on perioperative complication rates and its utility as a predictive tool for postoperative weight loss success. This can be achieved by conducting large prospective studies that are powered to detect differences in operative complications. Additionally, standardization in reporting postoperative weight loss would prove useful for performing future meta-analysis. Given the requirement of preoperative weight loss serves as an obstacle for some patients in obtaining access to bariatric surgery, more studies are essential.

Conclusions

Preoperative weight loss is not predictive of postoperative weight loss success after bariatric surgery. Greater preoperative weight loss was associated with a mild decreased in length of stay but was not associated with a reduction in operative time, overall complication rates, ICU admissions, or intraoperative complications. The inconclusive literature and our findings do not support the medical necessity of weight loss prior to bariatric surgery for the purpose of reducing surgical

complications or predicting successful postoperative weight loss success.

Declarations

Conflict of Interest The authors declare no competing interests.

References

1. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity Among Adults and Youth: United States, 2015-2016. NCHS Data Brief. 2017(288):1-8.
2. Afshin A, Forouzanfar MH, Reitsma MB, Sur P, Estep K, Lee A, et al. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. N Engl J Med. 2017;377(1):13-27.
3. Guh DP, Zhang W, Bansback N, Amarsi Z, Birmingham CL, Anis AH. The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. BMC Public Health. 2009;9:88.
4. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007-2017. Cardiovasc Diabetol. 2018;17(1):83.
5. Hassan MK, Joshi AV, Madhavan SS, Amonkar MM. Obesity and health-related quality of life: a cross-sectional analysis of the US population. Int J Obes Relat Metab Disord. 2003;27(10):1227-32.
6. Salminen P, Helmiö M, Ovaska J, Juuti A, Leivonen M, Peromaa-Haavisto P, Hurme S, Soinio M, Nuutila P, Victorzon M. Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss at 5 Years Among Patients With Morbid Obesity: The SLEEVEPASS Randomized Clinical Trial. JAMA. 2018;319(3):241-54.
7. Kang JH, Le QA. Effectiveness of bariatric surgical procedures: A systematic review and network meta-analysis of randomized controlled trials. Medicine (Baltimore). 2017;96(46):e8632.
8. Peterli R, Wölnerhanssen BK, Peters T, Vetter D, Kröll D, Borbély Y, Schultes B, Beglinger C, Drewe J, Schiesser M, Nett P, Bueter M. Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity: The SM-BOSS Randomized Clinical Trial. JAMA. 2018;319(3):255-65.
9. Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W, Fahrbach K, Schoelles K. Bariatric Surgery: A Systematic Review and Meta-analysis. JAMA. 2004;292(14):1724–1737. doi:https://doi.org/10.1001/jama.292.14.1724.
10. Hutter MM, Schirmer BD, Jones DB, Ko CY, Cohen ME, Merkow RP, Nguyen NT. First report from the American College of Surgeons Bariatric Surgery Center Network: laparoscopic sleeve gastrectomy has morbidity and effectiveness positioned between the band and the bypass. Ann Surg. 2011;254(3):410-20; discussion 20-2.
11. Böckelman C, Hahl T, Victorzon M. Mortality Following Bariatric Surgery Compared to Other Common Operations in Finland During a 5-Year Period (2009-2013). A Nationwide Registry Study. Obes Surg. 2017;27(9):2444-51.
12. Encinosa WE, Bernard DM, Steiner CA, Chen CC. Use and costs of bariatric surgery and prescription weight-loss medications. Health Aff (Millwood). 2005 Jul-Aug;24(4):1039-46.
13. Kim JJ. Evidence Base for Optimal Preoperative Preparation for Bariatric Surgery: Does Mandatory Weight Loss Make a Difference? Curr Obes Rep. 2017 Sep;6(3):238-245. doi: https://doi.org/10.1007/s13679-017-0269-4.
14. Brethauer S. ASMBS position statement on preoperative supervised weight loss requirements. Surg Obes Relat Dis. 2011;7(3):257–60.
15. Riess KP, Baker MT, Lambert PJ, Mathiason MA, Kothari SN. Effect of preoperative weight loss on laparoscopic gastric bypass outcomes. Surg Obes Relat Dis. 2008;4(6):704-8.
16. Anderin C, Gustafsson UO, Heijbel N, Thorell A. Weight loss before bariatric surgery and postoperative complications: data from the Scandinavian Obesity Registry (SOReg). Ann Surg. 2015;261(5):909-13.
17. Benotti PN, Still CD, Wood GC, Akmal Y, King H, El Arousy H, Dancea H, Gerhard GS, Petrick A, Strodel W. Preoperative weight loss before bariatric surgery. Arch Surg. 2009;144(12):1150-5.
18. Mechanick JI, Youdim A, Jones DB, Garvey WT, Hurley DL, McMahon MM, Heinberg LJ, Kushner R, Adams TD, Shikora S, Dixon JB, Brethauer S; American Association of Clinical Endocrinologists; Obesity Society; American Society for Metabolic & Bariatric Surgery. Clinical practice guidelines for the perioperative nutritional, metabolic and nonsurgical support of the bariatric surgery patient—2013 update: cosponsored by American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery. Obesity (Silver Spring). 2013 Mar;21 Suppl 1:S1-27. doi: https://doi.org/10.1002/oby.20461.
19. Losekann A, Weston AC, Carli LA, Espindola MB, Pioner SR, Coral GP. Nonalcoholic fatty liver disease in severe obese patients, subjected to bariatric surgery. Arq Gastroenterol. 2013 Oct-Dec;50(4):285-9. doi: https://doi.org/10.1590/S0004-28032013000400009.
20. Schwartz ML, Drew RL, Chazin-Caldie M. Laparoscopic Roux-en-Y gastric bypass: preoperative determinants of prolonged operative times, conversion to open gastric bypasses, and postoperative complications. Obes Surg. 2003;13(5):734-8.
21. Tewksbury C, Williams NN, Dumon KR, Sarwer DB. Preoperative Medical Weight Management in Bariatric Surgery: a Review and Reconsideration. Obes Surg. 2017 Jan;27(1):208-214. doi: https://doi.org/10.1007/s11695-016-2422-7.
22. Meguid MM, Glade MJ, Middleton FA. Weight regain after Roux-en-Y: a significant 20% complication related to PYY. Nutrition. 2008 Sep;24(9):832-42. doi: https://doi.org/10.1016/j.nut.2008.06.027.
23. Alami R MeA. Is there a benefit to preoperative weight loss in gastric bypass patients? A prospective randomized trial. Surgery for Obesity and Related diseases. 2007. p. 141-6.
24. Alvarado R, Alami RS, Hsu G, Safadi BY, Sanchez BR, Morton JM, Curet MJ. The impact of preoperative weight loss in patients undergoing laparoscopic Roux-en-Y gastric bypass. Obes Surg. 2005 Oct;15(9):1282-6.
25. Ali MR, Baucom-Pro S, Broderick-Villa GA, Campbell JB, Rasmussen JJ, Weston AN, Yamasaki JL, Fuller WD, Monash JB, Casillas RA. Weight loss before gastric bypass: Feasibility and effect on postoperative weight loss and weight loss maintenance. Surg Obes Relat Dis. 2007 Sep-Oct;3(5):515-20.
26. Taylor EL, Chiasson PM, Perey BJ. Predicting Bariatric Surgical Outcomes: Does Preoperative Weight Gain Correlate with Lesser Postoperative Weight Loss? Obes Surg. 1995 Nov;5(4):375-377.
27. Carlin AM, O'Connor EA, Genaw JA, Kawar S. Preoperative weight loss is not a predictor of postoperative weight loss after laparoscopic Roux-en-Y gastric bypass. Surg Obes Relat Dis. 2008 Jul-Aug;4(4):481-5.
28. Love KM, Mehaffey JH, Safavian D, Schirmer B, Malin SK, Hallowell PT, Kirby JL. Insurance-mandated medical programs before bariatric surgery: do good things come to those who wait?

Surg Obes Relat Dis. 2011 Jul-Aug;7(4):526-30. doi: https://doi.org/10.1016/j.soard.2010.08.017.
29. Krimpuri RD, Yokley JM, Seeholzer EL, Horwath EL, Thomas CL, Bardaro SJ. Qualifying for bariatric surgery: is preoperative weight loss a reliable predictor of postoperative weight loss? Surg Obes Relat Dis. 2018;14(1):60-64. doi:https://doi.org/10.1016/j.soard.2017.07.012.
30. Gerber P, Anderin C, Thorell A. Weight loss prior to bariatric surgery: an updated review of the literature. Scand J Surg. 2015;104(1):33–9. doi:https://doi.org/10.1177/1457496914553149.
31. Livhits M, Mercado C, Yermilov I, Parikh JA, Dutson E, Mehran A, Ko CY, Gibbons MM. Does weight loss immediately before bariatric surgery improve outcomes: a systematic review. Surg Obes Relat Dis. 2009;5(6):713–21. doi:https://doi.org/10.1016/j.soard.2009.08.014.
32. Ochner CN, Dambkowski CL, Yeomans BL, Teixeira J, Xavier Pi-Sunyer F. Pre-bariatric surgery weight loss requirements and the effect of preoperative weight loss on postoperative outcome. Int J Obes. 2012;36(11): 1380–7. doi:https://doi.org/10.1038/ijo.2012.60.
33. Lim R, Beekley A, Johnson DC, Davis KA. Early and late complications of bariatric operation. Trauma Surg Acute Care Open. 2018;3(1):e000219.
34. Acquafresca PA, Palermo M, Rogula T, Duza GE, Serra E. Early surgical complications after gastric by-pass: a literature review. Arq Bras Cir Dig. 2015;28(1):74-80.
35. Husain F, Jeong IH, Spight D, Wolfe B, Mattar SG. Risk factors for early postoperative complications after bariatric surgery. Ann Surg Treat Res. 2018;95(2):100-10.
36. Lewis MC, Phillips ML, Slavotinek JP, Kow L, Thompson CH, Toouli J. Change in liver size and fat content after treatment with optifast very low calorie diet. Obesity Surgery. 2006;16(6):697–701.
37. Giordano S, Victorzon M. The impact of preoperative weight loss before laparoscopic gastric bypass. Obes Surg. 2014;24(5):669-674.
38. Stefura T, Droś J, Kacprzyk A, Wierdak M, Proczko-Stepaniak M, Szymański M, Pisarska M, Małczak P, Rubinkiewicz M, Wysocki M, Rzepa A, Pędziwiatr M, Budzyński A, Major P. Influence of Preoperative Weight Loss on Outcomes of Bariatric Surgery for Patients Under the Enhanced Recovery After Surgery Protocol. Obes Surg. 2019;29(4):1134-1141. doi:https://doi.org/10.1007/s11695-018-03660-z
39. Still CD, Benotti P, Wood GC, Gerhard GS, Petrick A, Reed M, Strodel W. Outcomes of preoperative weight loss in high-risk patients undergoing gastric bypass surgery. Arch Surg. 2007;142(10):994-999. doi:https://doi.org/10.1001/archsurg.142.10.994
40. Van Nieuwenhove Y, Dambrauskas Z, Campillo-Soto A, van Dielen F, Wiezer R, Janssen I, Kramer M, Thorell A. Preoperative very low-calorie diet and operative outcome after laparoscopic gastric bypass: a randomized multicenter study. Arch Surg. 2011;146(11):1300-1305.
41. Roman M, Monaghan A, Serraino GF, Miller D, Pathak S, Lai F, Zaccardi F, Ghanchi A, Khunti K, Davies MJ, Murphy GJ. Meta-analysis of the influence of lifestyle changes for preoperative weight loss on surgical outcomes. Br J Surg. 2019;106(3):181-9.
42. Edholm D, Kullberg J, Haenni A, Karlsson FA, Ahlström A, Hedberg J, Ahlström H, Sundbom M. Preoperative 4-week low-calorie diet reduces liver volume and intrahepatic fat, and facilitates laparoscopic gastric bypass in morbidly obese. Obes Surg. 2011;21(3):345-50.
43. Huerta S, Dredar S, Hayden E, Siddiqui AA, Anthony T, Asolati M, Varela JE, Livingston EH. Preoperative weight loss decreases the operative time of gastric bypass at a Veterans Administration hospital. Obes Surg. 2008;18(5):508-12.
44. Sadhasivam S, Larson CJ, Lambert PJ, Mathiason MA, Kothari SN. Refusals, denials, and patient choice: reasons prospective patients do not undergo bariatric surgery. Surg Obes Relat Dis. 2007;3(5):531–5.