

Additional preparation program for bariatric surgery: Two-year results of a large cohort study

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Abstract

Background: Multidisciplinary screening of bariatric surgery candidates is recommended, and some centers provide an additional preparation program (APP) to optimize patients preoperatively.

Objective: To compare patients with APP to standard care 2 years after primary bariatric surgery regarding postoperative weight loss and resolution of obesity-related comorbidities.

Methods: A retrospective cohort study was conducted for patients undergoing primary Roux-en-Y gastric bypass and sleeve gastrectomy between September 2017 and March 2019. The first 12 months patients received an APP, after September 2018, the APP was no longer part of the weight loss trajectory. A multivariable linear regression model was built.

Results: Of the 384 patients receiving an APP advice, 50 were lost to follow up. In total, 192 (57%) received the APP and 142 (43%) received standard care. Percentage total weight loss after 2 years was significantly different, 28.8% for the APP group versus 32% for the standard group ($p = 0.001$). Postoperative weight loss after 2 years was increased in patients who had a gastric bypass, a higher baseline body mass index, and female gender in multivariable analysis. An APP was predictive for decreased postoperative weight. Diabetes mellitus was in remission significantly more often in the preparation group (84.1% of the cases) compared with the standard group (61.9%, $p = 0.028$).

Conclusion: A weight loss trajectory is at least as effective without additional preparation in terms of 2 years postoperative %TWL for primary gastric bypass and sleeve procedures. For comorbidities, diabetes mellitus was in remission more often in the APP group.

KEYWORDS

bariatric surgery, postoperative outcome, preoperative program

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1 | INTRODUCTION

Preoperative evaluation of bariatric surgery candidates is a recommended procedure in clinical practice and usually has a multidisciplinary approach such as clinical nutrition and psychosocial-behavioral evaluation.¹⁻³ In addition, some centers provide an additional preparation program. Some guidelines suggest that these interventions should include physical activity, diet and behavioral modification.¹ According to a systematic review by Swierz et al, the evidence on these programs remains controversial and hard to interpret considering the large variety of outcomes.⁴ Tewksbury et al. reviewed preoperative medical weight management (MWM) to provide investigated postoperative weight loss and alternative perspectives on the use of MWM. The paper concluded that the impact of MWM on postoperative weight loss remains arduous to assess because of unclear methods in studies. They suggest shifting MWM to focus on lifestyle modification as a preparation for surgery.⁵ Additionally, Gasoyan et al. added that insurance-mandated precertification criteria such as undergoing a 3 to 6 months preoperative program might not positively impact patient outcomes.⁶

Another review stated that the support of a multidisciplinary team is important preoperatively, but intensive multidisciplinary interventions could enhance postoperative weight loss if delivered in the postoperative period.² Among these included interventions were lifestyle counseling, cognitive behavioral therapy (CBT) and exercise. The effect of a multidisciplinary intervention on postoperative obesity related co-morbidities was also included in this review, but only one study reported outcomes on co-morbidity incidence. Therefore, the mid-term effect of preoperative multidisciplinary interventions on postoperative weight loss and resolution of obesity-related comorbidities remains unknown.

In the obesity center of the authors, additional preparation programs (APP) focused on nutrition and behavior modification rather than weight loss and was suggested by the multidisciplinary team in 50% of the patients. This policy changed after a reassessment of the trajectory by omitting these programs, but the multidisciplinary discussions continued in the same manner. Therefore, an opportunity arose to compare postoperative outcomes of standard care to APP patients. Rather than mandating preoperative programs for every patient, this center decided who needed extra guidance based on preoperative screening. This study focused on weight loss and resolution of comorbidities in patients with APP compared with standard care 2 years after primary bariatric surgery. The hypothesis was that patients in the APP achieved more weight loss postoperatively compared with the standard group.

2 | MATERIALS AND METHODS

A retrospective cohort study was conducted between September 2017 and March 2019. Data on weight, length, sex, age, and the multidisciplinary discussion result were collected from patients who underwent primary sleeve gastrectomy (SG) or Roux-en-Y gastric

bypass (RYGB).⁷ This study was approved by the local Institutional Review Board and informed consent was obtained from all patients. Patients who were lost to follow-up, who underwent secondary surgery, or were pregnant before the 2-year postoperative mark were excluded from this study.

2.1 | Screening procedure

All patients underwent screening before surgery, consisting of an educative session after which patients gained access to an eHealth platform on which informational videos, e-learning, and screening questionnaires were provided. When the questionnaires on quality of life, eating behavior and symptoms of psychopathology were completed, patients returned for appointments with an obesity nurse, physiotherapist, psychologist and dietitian.^{8,9} Additionally, blood samples were taken to detect preoperative vitamin deficiencies. Finally, the patients attended a support group session on commitment, which is necessary for the lifestyle adjustments after surgery.

2.2 | Multidisciplinary discussion

The results of the preoperative screening of all patients were discussed by the obesity team according to the International Federation for the Surgery of Obesity and Metabolic Disorders guidelines to determine whether a patient was approved for surgery, denied due to contra-indications, or required additional guidance by use of a preoperative APP.¹⁰ The APPs are provided by a dietitian, a psychologist, or a combination of both. The screening questionnaires were used to determine which patient needed more guidance, based on both a scoring system and subjective considerations.

In this study, all patients underwent multidisciplinary screening according to protocol (Figure 1). Only patients receiving an APP advice were included, therefore leaving direct approvals or denials at the time out of scope. From September 2017 until September 2018, patients received an APP if this was advised by the multidisciplinary team. From September 2018 until March 2019, the APP was temporarily no longer part of the weight loss trajectory due to a policy change as these programs were time consuming and demanding for available health resources. However, the multidisciplinary consultations continued during this time to evaluate the high-risk patients; this overruled the non-APP policy if the team considered bariatric surgery without additional counseling hazardous. These patients were excluded from the analysis.

2.3 | Additional preparation program

A program provided by a psychologist consisted of CBT on stressful life events, self-control, impulse control, emotion regulation, and coping strategies. Preoperative programs by dietitians focused on dietary knowledge and eating habits such as eating pace and food

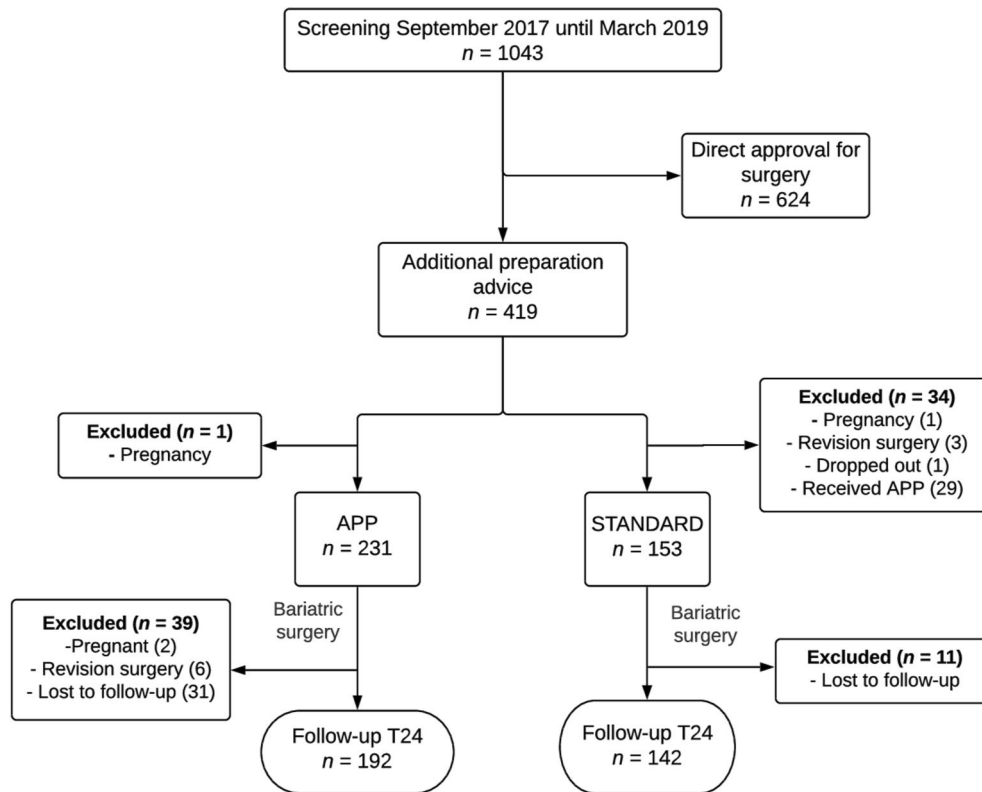


FIGURE 1 Flowchart of the study procedure.

restriction. Both disciplines have an average of three consultations in their programs but could be extended to six appointments if necessary. This program delayed scheduling surgery for around 2 months. The standard group went straight for surgery after completing the screening procedure and multidisciplinary discussion.

2.4 | Follow up after surgery

All patients underwent the same follow up. Postoperative follow-up care consists of consultations with a physician lasting 5 years. There are four visits during the first postoperative year, two in the second year, and thereafter once a year. The primary outcome was total weight loss (TWL) after 2 years, measured as the percentage difference between weight at screening and weight after 24 months. Secondary outcomes included the resolution of comorbidities, for diabetes mellitus (DM) this meant if patients were in remission and could stop with their (tablets or insulin) medication and HbA1c was <48 mmol/mol. The HbA1c values itself were unfortunately not collected.

2.5 | Statistical analysis

Baseline characteristics were compared between the standard and APP cohorts, univariate analyses were performed using Student's *t*-test or Wilcoxon Rank-sum test in continuous data, and the Fishers-exact test in dichotomous or categorical data. A multivariable

linear regression model was built to correct for confounders and to estimate the relationship between the independent variables on postoperative TWL after 2 years. Backward selection of the clinically relevant and univariate significant confounders was used ($p < 0.1$). Continuous variables in normally distributed data were presented as mean and standard deviation (SD), not normally distributed data were reported as median and interquartile range. If necessary, the confidence intervals (CI) were mentioned as well.

Statistical analyses were performed using SPSS software (version 26). Significance levels were set for p -value < 0.05.

3 | RESULTS

Of the 419 patients who initially received additional preparation program advice, 35 were excluded from analysis due to pregnancy ($n = 2$), revisional surgery ($n = 3$), dropped-out of study ($n = 1$) or received an APP ($n = 29$) as decided by the multidisciplinary team (Figure 1). Of the remaining 384 patients who underwent bariatric surgery, 42 patients were lost to follow up two years postoperatively, six were excluded because revisional surgery was performed within the 2-year follow-up and two became pregnant.

The baseline characteristics of the remaining 334 patients are described in Table 1, of which 192 (57%) patients received an additional preparation program and 142 (43%) received standard care. There were significant differences in the type of surgery, DM type 2, and musculoskeletal pain between the APP and standard cohort

TABLE 1 Baseline characteristics.

	APP <i>n</i> = 192	Standard <i>n</i> = 142	<i>p</i> -value
Demography			
Gender			
Male	50 (26%)	46 (32.4%)	0.222
Female	142 (74%)	96 (67.6%)	
Age, mean, years (SD)	46.0 (11.0)	46.6 (11.0)	0.944
BMI, mean, kg/m ² (SD)	42.6 (4.5)	42.3 (4.4)	0.759
Type of surgery			
Gastric sleeve	135 (70.3%)	67 (47.2%)	0.001
Roux-en-Y Gastric bypass	57 (29.7%)	75 (52.8%)	
Obesity related co-morbidities			
Hypertension	72 (37.5%)	61 (43%)	0.366
Dyslipidemia	37 (19.3%)	35 (24.6%)	0.282
Diabetes mellitus II	25 (13%)	34 (23.9%)	0.013
Gastroesophageal reflux disease	38 (19.8%)	20 (14.1%)	0.191
Obstructive sleep apnea syndrome	33 (17.2%)	22 (15.5%)	0.766
Musculoskeletal pain	99 (51.6%)	37 (26.1%)	0.001
Intoxications			
Smoking	44 (22.9%)	22 (15.5%)	0.097
Alcohol	110 (57.3%)	82 (57.7%)	0.999
Quality of life			
RAND-36, mean, (SD)	50.92 (17.2)	53.14 (17.1)	0.882
SQ-48, mean, (SD)	35.92 (17.7)	34.26 (17.6)	0.786
Hospital stay			
One day	163 (84.9%)	111 (78.2%)	0.192
Two days	25 (13%)	24 (16.9%)	
> Two days	3 (2.1%)	7 (4.9%)	

Abbreviations: BMI, Body Mass Index; SD, standard deviation; SQ; symptom questionnaire.

($p = 0.001$, $p = 0.008$, and $p = 0.001$ respectively). Hospital stay was not significantly different between cohorts.

There was a significant difference in %TWL after 2 years between the two cohorts; mean weight loss was 28.8% (SD 9.1) for the APP group and 32% (SD 8.6) for the standard group ($p = 0.001$ CI (1.269–5.147)). The change in mean Body mass index (BMI) from baseline until 2 years postoperative was -12.3 kg/m² (SD 4.4) and -13.6 kg/m² (SD 4.1) ($p = 0.008$ CI (-2.590 ; -0.614)) respectively. Intention-to-treat analysis also showed these significant differences in %TWL at 2 years postoperative ($p = 0.003$).

In a multivariable linear regression model, type of surgery, BMI, and receiving an additional preparation program significantly predicted %TWL 2 years postoperatively (Table 2). The variables gastric bypass procedure, a higher baseline BMI, and female gender led to higher postoperative weight loss after 2 years. Older age and receiving a preoperative program led to less postoperative weight loss.

Of the analyzed obesity-related co-morbidities, only DM type 2 showed significant differences between the APP and standard cohort (Table 3). Diabetes was in remission in 84.1% of the cases with additional preparation programs compared to 61.9% of the patients who underwent surgery without a program ($p = 0.028$).

4 | DISCUSSION

This retrospective cohort study aimed to investigate two years postoperative percentage TWL in 191 patients who received an additional preoperative preparation program and 142 patients who received standard care. The primary goal of the APP is to change behavior, increase knowledge on healthy nutritional intake and develop skills to control impulses rather than preoperative weight loss. This study adds that programs were only administered to patients who were deemed to need more guidance based on professional opinions. There were

TABLE 2 Univariate and multivariable linear regression model.

	B (SE)	Confidence intervals	p value	B (SE)	Confidence intervals	p value
Cohort (standard/APP)	-3.207 (0.986)	-5.147 to 1.268	0.001	-2.025 (0.952)	-3.897 to 0.152	0.034
Gender (male/female)	1.320 (1.091)	-0.827 to 3.467	0.227	1.074 (1.014)	-0.920 to 3.068	0.290
Type of surgery (SG/RYGB)	5.774 (0.962)	3.883 to 7.666	0.001	6.197 (0.986)	4.257 to 8.137	0.001
Age, mean, years (SD)	-0.046 (0.045)	-0.135 to 0.042	0.304	-0.074 (0.042)	-0.156 to 0.008	0.078
BMI, mean, kg/m ² (SD)	0.279 (0.111)	0.061 to 0.496	0.012	0.419 (0.105)	0.213 to 0.626	0.001
Hypertension	-0.218 (1.011)	-2.207 to 1.771	0.830			
Dyslipidaemia	1.544 (1.201)	-0.818 to 3.906	0.199			
Diabetes mellitus II	-0.311 (0.649)	-1.587 to 0.965	0.632			
GERD	2.300 (1.301)	-0.259 to 4.859	0.078			
OSAS	-2.367 (1.328)	-4.981 to 0.246	0.076			
Musculoskeletal pain	0.476 (1.007)	-1.505 to 2.458	0.637			
Smoking	0.508 (1.243)	-1.937 to 2.953	0.683			
Alcohol	0.772 (1.000)	-1.196 to 2.740	0.441			
Hospital stay	0.474 (1.025)	-1.542 to 2.490	0.644			

Abbreviations: GERD, Gastroesophageal reflux disease; OSAS, Obstructive sleep apnea syndrome; RYGB, Roux-en-Y Gastric Bypass; SG, Sleeve Gastrectomy; SD, standard deviation.

TABLE 3 The resolution of obesity-related co-morbidities.

	n	In remission	Improved	Unchanged	Deteriorated	De novo	p-value
Hypertension							
APP	186	60.3%	26.5%	13.2%	0%	0%	0.175
Standard	138	44%	40.7%	15.3%	0%	0%	
Dyslipidemia							
APP	186	45.8%	20.3%	25.4%	6.8%	1.7%	0.345
Standard	137	31.6%	21.1%	44.7%	2.6%	0%	
Diabetes mellitus II							
APP	186	84.1%	15.9%	0%	0%	0%	0.028
Standard	137	61.9%	28.6%	4.8%	4.8%	0%	
Gastroesophageal reflux disease							
APP	186	48.3%	10.3%	13.8%	17.2%	10.3%	0.650
Standard	138	55.6%	18.5%	18.5%	7.4%	3.7%	
Obstructive sleep apnea syndrome							
APP	186	48.1%	33.3%	18.5%	0%	0%	0.889
Standard	137	58.9%	29.4%	11.8%	0%	0%	
Musculoskeletal pain							
APP	186	43.2%	43.2%	8.1%	5.4%	0%	0.583
Standard	136	33.3%	37%	22.2%	7.4%	0%	

Abbreviation: APP, Additional preparation program.

significant differences in %TWL after 2 years between groups in favor of the standard group. The effects of preoperative interventions on behavior and diet are limited and controversial.¹¹ A recent study by Paul et al. randomizing 65 patients to preoperative and postoperative

CBT revealed that preoperative CBT does not contribute to better postoperative outcomes regarding BMI compared to standard care.¹² However, the systematic review by David et al. stated that there were significant benefits of psychosocial interventions for weight loss

compared with the control group, but these differences did not maintain 1–4 years post-surgery.¹³ For diet, the majority of literature focuses on low-calorie diets that aim to reduce perioperative complications rather than higher postoperative weight loss.^{3,14} Some studies suggest that a preoperative diet for 2 weeks is associated with postoperative weight loss, most pronounced in the first 6 months but fading after 2 years.¹⁵ Others described no differences compared to no diet, and even Ying Tse Tan et al. reported reduced postoperative weight loss and no effect on complications or percentage excess BMI loss.^{16,17} The additional preparation program led by dietitians in this study aimed to increase dietary knowledge and improve eating habits. Literature has shown associations between eating self-efficacy and weight loss after bariatric surgery, defined as the confidence to control eating in challenging situations.¹⁸ A prospective cohort study showed improvements in eating self-efficacy at 16 and 55 months postoperatively.¹⁹

In this study, when corrected for other variables such as the type of surgery, BMI and age, patients not receiving an additional preparation program led to similar results as the standard group. This might be the result of the multidisciplinary team struggling to find the right indications for preoperative counseling, or benefits of the program might show in the longer term, for example, after 5 years. It appears that tailored guidance is not associated with greater weight loss.^{5,6} Tewksbury and colleagues reviewed studies of the relationship between preoperative weight loss and postoperative outcomes.⁵ The results were not uniform and precluded the authors from making definitive conclusions on the relationship. They suggested that improvements in diet quality and eating behavior might be a more appropriate target for these preoperative interventions. Gasoyan et al. recently investigated the relationship between the requirement of 3–6 months preoperative weight management and ultimately undergoing surgery, which was required by many private insurance companies in the United States.⁶ Required participation in these programs was associated with significantly smaller odds of completing surgery, suggesting that the requirement is a barrier to greater utilization of surgery.

In the APP group, 70% underwent SG versus 47% in the standard group. Several authors have investigated the difference in weight loss between these surgical techniques, resulting in multiple systematic reviews and meta-analyses.^{20–25} Of the six articles, Lee et al. stated that RYGB was superior in loss of BMI at 1 year postoperatively, and Meneses et al. stated that there was a superiority trend for RYGB for long-term weight loss but uncertain for BMI.^{20,21} The other three articles, that is, Osland et al, Shoar et al., and Li et al., all showed slightly more weight loss in the RYGB cohorts but was insignificant in the meta-analyses.^{22–25} For 2 years postoperative results, a systematic review by Zhang et al. showed that out of 9756 cases, patients receiving RYGB had a lower BMI and higher percentage weight loss compared to SG.²⁶ Additionally, a multicenter randomized controlled trial of Wallenius et al. showed superior excess weight loss 2 years after RYGB compared to SG.²⁷ Some of the weight loss differences between the APP and standard groups might be explained by the different surgical procedures received.

As for comorbidities, the only significant difference between the APP and standard group was DM, which seemed more in remission compared to the standard group. However, in the standard group, 61% of the patients with diabetes were also in remission 2 years after surgery. In the current literature, preoperative weight loss programs do not seem to affect comorbidity resolution.^{28–32}

There are several limitations to this study; 50 patients were lost to follow-up almost certainly due to the coronavirus pandemic.³³ Additionally, this study only investigated the use of an additional program preoperatively rather than postoperatively; some studies suggest that initiating treatment in the early postoperative phase leads to better results.¹³ Even though the permanent multidisciplinary team remained the same, as in the questionnaires and phrasing of the decision, the knowledge of the policy change still could have influenced the multidisciplinary team's decision. This effect was present, as additional counseling was provided in 29 patients despite the no-program policy. Lastly, the preoperative questionnaires were not repeated after completing the additional preparation program.

Nevertheless, the benefits of an additional program should be in the mid or long-term. This study showed the 2-year results in weight loss and comorbidity resolution in a large cohort comparing standard care with the additional preparation programs. Although the specific contents of the preparation program can differ between centers, if minimum educative sessions were provided and no contra-indications were identified at the multidisciplinary team discussions, the results of this study can be generalized. In other words, not providing an additional preoperative program can result in a similar percentage of weight loss 2 years after surgery.

5 | CONCLUSION

A weight loss trajectory without an additional preparation program showed more 2 years postoperative weight loss for primary gastric bypass and sleeve procedures. Concerning comorbidities, DM was in remission more often in the group receiving an additional preparation program.

AUTHOR CONTRIBUTIONS

Yentl Lodewijks: Conceptualization; Methodology; Data curation; Writing original draft; Writing review and editing. **Misha Luyer:** Methodology; Investigation; Data curation; Writing review and editing. **Gust van Montfort:** Formal analysis; Investigation; Data curation; Writing review and editing. **Jean-Paul de Zoete:** Conceptualization; Data curation. Writing review and editing. **Frans Smulders:** Formal analysis; Writing review and editing. **Simon Nienhuijs:** Conceptualization; Project administration; Writing review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

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