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ORIGINAL CONTRIBUTIONS

Perceived Postoperative Support Differentiates Responders from Non-Responders 3 Years After Laparoscopic Roux-en-Y Gastric Bypass

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Abstract
Background Bariatric surgery is an effective intervention for the majority of patients with morbid obesity, but a significant minority fails to achieve substantial weight loss. In the search of possible predictors of weight loss following bariatric surgery, preoperative factors turn out to have limited predictive power. This study will examine the impact of two postoperative factors on weight loss: perceived social support and stressful life events.
Methods From the entire 2013 cohort that underwent laparoscopic Roux-and-Y gastric bypass (LRYGB) in a general hospital in the Netherlands, a group of 56 non-responders and a matched group of 56 responders were selected, using an alterable weight loss (%AWL)-based percentile chart. Patients from both groups were interviewed by phone to collect data on demographics, medical complications and comorbidities, social support and stressful life events. A total of 61 patients completed the data collection (54% response rate).
Results One-way ANOVA analysis showed that responders and non-responders differed with regard to perceived support ($F(1) = 8.60$, $p = .005$). In a model with place of birth, level of education and pre-surgery diabetes mellitus as covariates, perceived social support was able to classify 83.6% of patients correctly as either responder or non-responder ($\chi^2 = 28.26$, $p < .001$). Stressful life events turned out to be unrelated to weight loss.
Conclusions Perceived social support differentiates responders from non-responders after LRYGB. When patients present themselves after LRYGB with sub-optimal weight loss, social support should be a focus of attention.

Keywords Obesity · Gastric bypass · LRYGB · Weight gain · Postoperative determinants · Psychological determinants · Adherence · Life-events · Social support

Introduction

Morbid obesity is a chronic disease that is caused and maintained by a complex interplay of medical-somatic, psychological and social factors. Bariatric surgery, and laparoscopic Roux-and-Y gastric bypass (LRYGB) in particular, is currently the most successful and cost-effective treatment for morbid obesity [1–4]. While most patients clearly benefit from LRYGB, there are large differences in post-surgical weight loss [5]. A significant minority of patients fails to achieve sufficient weight loss [6–8].

Identifying patients at risk of sub-optimal results after bariatric surgery is important for the development of personalized care, but remains challenging. Several preoperative psychological risk factors have been identified [9–12], but their associations with weight loss are typically rather weak [13]. Shifting attention to postoperative risk factors might be a more promising research direction, which has resulted in a limited body of evidence so far [14]. Our aim is to expand on this

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body of evidence by examining two possible postoperative predictors of weight loss: social support and stressful life events. In studies of non-surgical weight loss interventions, social support emerged as a reliable predictor of weight loss [15, 16] and correlate of weight loss maintenance [17]. In a review of social support and weight loss after bariatric surgery [18], support group attendance turned out to be associated with greater postoperative weight loss, but the impact of family and social support was inconclusive. The impact of experiencing stressful life events postsurgically has not yet been studied in a bariatric surgery sample. In non-surgical studies, experiencing stressful life events such as major illness, bereavement and family stress has been associated with weight regain [17]. Higher stress is related to altered appetite regulation [19], reductions in physical activity [20] and less healthy dietary behaviors and higher body weight [21].

The present study will examine whether social support and stressful life events differentiates responders from non-responders after LRYGB. To identify responders and non-responders, we will use the alterable weight loss (%AWL)-based percentile chart, as developed by Van de Laar, De Brauw, Bruin and Acherman (2016) [22], in response to the ongoing debate on the ideal parameter for judging outcome after bariatric surgery [23–29]. The %AWL-based percentile chart has several advantages over more traditional bariatric measures; it is baseline-BMI independent, allows comparison of heavier patients with lighter peers and vice versa, and has superior sensitivity and specificity in distinguishing responders from non-responders. As such, it entails an innovation to bariatric surgery research.

Materials and Methods

Study Population and Data Collection

This retrospective cross-sectional cohort study took place in XXX between January and December 2016. Permission to conduct the study was obtained from the Institutional Review Board. All patients who underwent primary LRYGB in 2013 and had at least 1 year follow-up data available were benchmarked with the primary LRYGB weight loss percentile curves of our center [22].

All patients were screened preoperatively by a bariatric surgeon, an endocrinologist, a dietician, and a psychologist. We used the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) criteria to determine eligibility for surgery: body mass index (BMI) ≥ 40, or BMI ≥ 35 together with at least one or more obesity-related comorbidities, such as type II diabetes (T2DM), hypertension, sleep apnea, osteoarthritis, or lipid abnormalities, and the inability to achieve a healthy weight loss sustained for a period of time with prior weight loss efforts. All patients were operated after written informed consent. All LRYGB were standardized, with a gastric pouch of 4 cm in width and 8 cm in length, a 50-cm biliary limb, and a 150-cm ante-colic, ante-gastric alimentary limb. All patients received multiple appointments with our multidisciplinary team during the first 2 years postoperative, and annually thereafter. At all appointments, patients were weighed with the same type of scale. Patients not showing up were contacted and scheduled for a new appointment. All data were collected prospectively in a central electronic database.

Patients were identified as non-responders if their latest %AWL result was situated below the 10th percentile (< p10) of the weight loss chart. Patients were identified as responders if their latest result was situated within the inter quartile range (p25–p75). Each non-responder was randomly matched to a responder by age and gender. Patients from these two equally sized groups were approached, first in writing and then by phone to solicit their participation. Five attempts were made to reach patients by phone, at various times of day and week. Upon agreement to participate, patients were interviewed by phone. Interviewers were blind to the weight loss status of participants.

Measurements

Data were collected by means of a structured interview by phone and from clinical documentation. Various demographic characteristics were gathered (age, place of birth, level of education, relationship status), as well as medical information from medical charts pertaining to common LRYGB complications (e.g., infection, leakage, vitamin deficiencies, ulcers) and common obesity comorbidities (e.g., diabetes mellitus, hypertension).

The main variables of interest in this study were perceived social support and stressful life events. Perceived social support was assessed by asking patients about the significant others in their lives and to what extent they felt supported by these significant others in adhering to both dietary recommendations and exercise recommendations. Response alternatives ranged from 1 (not at all) to 10 (completely). Ratings for perceived dietary and exercise support were summed to form a total score, ranging from 2 to 20. Stressful life events were assessed by asking patients whether or not they experienced any life events since surgery, choosing from a list of 14 common life events (e.g., illness, death of a loved one, divorce, financial problems, unemployment).

Statistical Analysis

Data were analyzed using SPSS 22.0 software. Normality of the data was inspected. We tested whether responders and non-responders were adequately matched regarding age and gender. Both groups were then compared with regard to time since

surgery (in months), place of birth (European vs non-European), level of education (high vs low), relationship status (being in a relationship vs not being in a relationship), complications during or after surgery (yes vs no), and comorbidities (yes vs no). For dichotomized variables, chi-squared tests were used, and for the linear variable, an ANOVA was used. Those variables that differed between responders and non-responders were used as covariates in the main analyses. Next, differences between responders and non-responders regarding perceived support and number of life-events (0 or 1, 2, or 3 and more than 3) were investigated with ANOVA and chi-squared statistics, respectively. These analyses were then repeated controlling for covariates, using the binary logistic regression analysis.

Results

Patient Characteristics

A total of 779 patients underwent primary LRYGB in 2013. For 586 patients, follow-up data beyond the first postoperative year were available. Of those, 56 (9.6%) were identified as non-responders (below the 10th percentile) and 296 (50.5%) as responders (within the inter quartile range). From the group of responders, 56 patients were matched on age and gender to the non-responders. Of the 112 selected patients, 61 (54%) agreed to participate and completed the data collection. This resulted in a study sample of 26 non-responders and 35 responders, with an average follow-up time of 3 years. No differences in the number of responders and non-responders were found in those who participated and in those who did not. Also, participants and non-participants did not differ with regard to gender, age and time since operation.

Analysis of Covariates

Responders and non-responders turned out to be adequately matched as age and gender did not differ between both groups. Also, there turned out to be no differences in pre-surgery BMI, time since surgery, or complications between both groups (Table 1). Responders and non-responders did differ with respect to place of birth and level of education. That is, chi-squared test showed that patients born within Europe ($\chi^2 = 5.33$, $p = .021$) were more likely to be a responder than those born outside Europe (i.e., Aruba, Suriname, or Egypt) (OR = 6.08). Similarly, patients with a higher education ($\chi^2 = 6.21$, $p = .013$) were more likely to be a responder than patients with a lower education (OR = 3.94). Responders and non-responders also differed with respect to diabetes mellitus before surgery. Responders were less likely ($\chi^2 = 6.04$, $p = .014$) to have had diabetes than non-responders (OR = .24). Place of birth, level of education and diabetes were included as covariates in the final analyses.

Table 1 Sample characteristics, $N = 61$

	Responders	Non-responders	Total
BMI before operation, mean (SD)	42.13 (4.09)	43.79 (4.05)	
Last known BMI[a], mean (SD)	28.08 (2.49)	35.15 (3.49)	
%AWL[a], mean (SD)	48.23 (4.44)	28.00 (6.19)	
Gender			
Female, *n*	24	18	42
Male, *n*	11	8	19
Age, mean (SD)	46.54 (9.59)	53.12 (8.34)	51.07 (9.18)
Time since surgery, months, mean (SD)	36.24 (4.64)	35.15 (3.16)	35.77 (4.07)
Place of birth [a]			
European, *n*	33	19	52
Non-European, *n*	2	7	9
Education level [a]			
High, *n*	27	12	39
Low, *n*	8	14	22
Intimate relationship			
Yes, *n*	28	16	44
No, *n*	6	10	16
Diabetes mellitus [a]			
Yes, *n*	6	12	18
No, *n*	29	14	43
Complications			
Yes, *n*	10	5	15
No, *n*	29	14	43
Perceived support[a] mean (SD)	16.48 (3.25)	13.39 (4.96)	15.16 (4.31)
Number of life events			
0 or 1, *n*	12	11	23
2 or 3, *n*	17	10	27
> 3, *n*	6	5	11

[a] Significant difference between responders and non-responders

Social Support and Life Events

One-way ANOVA analysis showed that responders and non-responders differed with regard to perceived support ($F(1) = 8.60$, $p = .005$). That is, responders reported more support (95% confidence interval (CI) 15.36–17.59) than non-responders (95% CI 11.39–15.39). Next, binary logistic regression analysis showed that after controlling for place of birth, level of education and diabetes, perceived social support did differentiate responders from non-responders (Table 2). This model was able to classify 83.6% of the patients correctly as either responder or non-responder ($\chi^2 = 28.26$, $p < .001$). Responders were classified with 85.7% accuracy, and non-responders, with 80.8% accuracy. Chi-squared statistics showed that the

Table 2 Perceived support differentiates responders from non-responders

	B	S.E.	Wald	Sig.	−2 log likelihood
Step 0					83.23
Constant	−6.15	1.84	11.15	.001	
Step 1					68.10
Education	1.66	.71	5.52	.02	
Place of birth	2.20	1.03	4.58	.03	
Diabetes mellitus 2	−1.62	.75	4.70	.03	
Step 2					54.97
Perceived support	.27	.09	9.57	.002	

Coefficients of the final model are presented

number of life-events did not differ between responders and non-responders. Consequently, no further analyses were conducted for number of life events.

Discussion

The aim of the present study was to investigate differences between responders and non-responders after gastric bypass surgery. It appeared that patients who were born outside Europe (non-Caucasian), those with a lower education, those with diabetes mellitus before surgery and those who feel less supported by their loved ones in complying with the diet and exercise regimen are overrepresented in the group of non-responders. That is, on the basis of these variables, we were able to classify 83.6% of the patients correctly as either responder or non-responder. Evaluation of the covariates may suggest that the combination of economic, ethnic and cultural factors in combination with the presence of diabetes may strain social support which may impact weight loss in patients undergoing LRYGB. In contrast to expectations, the number of life events did not differ between both groups. The number of patients included in this study born outside Europe was small, and therefore, we reanalyzed the data excluding "place of birth" as covariate in the binary logistic regression analysis. The results remained roughly the same while the percentage accurately classified patients dropped from 83.6 to 68.9% (73.1% of the non-responders, 65.7% of the responders) without this variable. The finding that non-Caucasian patients are overrepresented in the group non-responders is in line with previous studies showing that ethnicity seems to be associated with bariatric surgery outcomes [30]. Also, the finding that patients with diabetes may be at risk of insufficient weight loss has been reported before [31]. The pathophysiology underlying these associations remains unclear and warrants additional research.

The significant impact of social support on weight loss is in line with a growing body of research showing that interpersonal relationships have a big impact on sickness and health. For example, two meta-analytic reviews [32, 33] showed that poor social support is as strongly associated with mortality as smoking and has an even bigger impact on mortality than obesity. Social support is shown to exert influence on sickness and health through two different mechanisms. First, social support acts as a stress buffer, as the perception that others will provide support and assistance strengthens one's perceived ability to cope with demands [34]. Second, social support has main effects, irrespective of stress, because it fosters positive psychological states, provides information and motivation and is a source of social pressure to care for oneself [34]. When it comes to changing lifestyle behaviors, social support has been shown to enhance perceived control and self-efficacy in patients [35] and to promote adherence to diet and exercise regimens [36]. Adherence is promoted by encouraging optimism and self-esteem, buffering stresses, reducing depression, and giving practical assistance [37]. Of particular interest, when it comes to reducing fat intake, the degree to which family members change their own habits appears significant [38]. Many family members of bariatric surgery patients also live with overweight and obesity and report disinhibited eating and a high degree spent in sedentary behaviors [39]. The non-responders in our study reporting low diet-related social support could be struggling with family members still engaging in unhealthy lifestyle behaviours, negatively influencing their own lifestyle choices. The exact mechanisms through which social support or the lack thereof impacts weight loss after bariatric surgery could be a focus of future research.

Our study has some clear strengths, such as the use of percentile charts that allow for the comparison of weight loss among patients with a different baseline body mass index [22] and an average follow-up of 3 years. Most studies focus on weight loss within the first 2 years after bariatric surgery, but sub-optimal results may only become visible more than 2 years after surgery [40]. Our study also has some notable limitations. The main limitation of the study is the small study sample. We specifically targeted patients below the tenth weight loss percentile, to form a group of non-responders that was small by definition. The response rate in this group was 46% and this rather low response rate may have affected the study results and may limit their generalizability. The finding that willingness to participate was comparable in responders and non-responders indicates that willingness to participate was independent of weight loss. This is in contrast with previous suggestions that patients who fail to lose weight may be underrepresented in research [41]. Another limitation is the assessment of perceived social support with a small number of self-report items. Future research could examine the impact of social support on weight loss using validated measurements such as the Social Support for Healthy Behaviors scale [42]. Replication studies should ideally use a longitudinal design, as

the cross-sectional design of our study prevents us from drawing conclusions about causality. It could be that the lower ratings for perceived support in the group of non-responders were biased by their poor weight loss outcome.

The present results may have clinical implications. When patients present themselves after LRYGB with sub-optimal weight loss, social support should be a focus of attention. Although the majority of patients preoperatively perceive high levels of support for healthy eating and physical activity [39], the current study indicates that postoperatively levels of perceived support vary, with implications for weight loss. Mobilizing social support after surgery could be a relatively easy and cost-effective strategy for improving outcome [35]. In addition, it could be argued that weight loss of patients with a lower education and with diabetes mellitus 2 before surgery should be monitored more closely as they may be at risk of sub-optimal results.

Compliance with Ethical Standards

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

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