



Attachment Anxiety Predicts Poor Adherence to Dietary Recommendations: an Indirect Effect on Weight Change 1 Year After Gastric Bypass Surgery

Floor Aarts · Rinie Geenen · Victor E. A. Gerdes · Arnold van de Laar · Dees P. M. Brandjes · Chris Hinnen

Published online: 10 September 2014
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Abstract

Background Weight loss after gastric bypass surgery depends on the adoption of healthy dietary recommendations, which may be influenced by psychological issues and patients' attachment representations (habitual states of mind with respect to interpersonal relations). The present study tests (1) whether attachment representations are associated with dietary adherence, (2) whether dietary adherence and weight loss are correlated and (3) whether dietary adherence mediates the relation of attachment representations with weight reduction after gastric bypass surgery. Besides attachment representations, psychological problems are examined.

Methods This longitudinal study included 105 patients who had a laparoscopic Roux-en-Y gastric bypass operation. Current and past psychological problems and attachment representations were assessed before surgery. Dietary adherence was assessed 6 and 12 months postsurgery. Patients' weight and height were collected from medical records. Multiple

linear and logistic regression analyses and mediation analyses using bootstrapping resampling procedures were conducted. **Results** Of all examined predictor variables, attachment anxiety, i.e. fear of social rejection and abandonment, was most strongly associated with low dietary adherence at both 6 months ($p=0.009$) and 12 months ($p=0.006$) postsurgery. Dietary adherence 6 months postsurgery was associated with weight loss 1 year after the operation ($p=0.003$). Dietary adherence at 6 months ($\beta=0.51$; 95 % confidence interval (CI)=0.19–1.04) mediated the association between preoperative attachment anxiety and postoperative weight loss. **Conclusions** The results suggest that more anxiously attached patients are less adherent to dietary recommendations 6 months after gastric bypass surgery, influencing weight loss in a negative way during the first year after surgery.

Keywords Attachment · Psychological problems · Bariatric surgery · Adherence · Weight loss

F. Aarts (✉) · V. E. A. Gerdes · D. P. M. Brandjes
Department of Internal Medicine, Slotervaart Hospital, Louwesweg 6, 1066 EC Amsterdam, The Netherlands
e-mail: Floor.Aarts@slz.nl

V. E. A. Gerdes
e-mail: v.e.gerdes@amc.uva.nl

D. P. M. Brandjes
e-mail: d.brandjes@upcmail.nl

F. Aarts · C. Hinnen
Department of Medical Psychology/Hospital Psychiatry, Slotervaart Hospital, Amsterdam, The Netherlands

C. Hinnen
e-mail: Chris.Hinnen@slz.nl

R. Geenen
Department of Clinical and Health Psychology, Utrecht University, Utrecht, The Netherlands
e-mail: r.geenen@uu.nl

V. E. A. Gerdes · D. P. M. Brandjes
Department of Vascular Medicine, Academic Medical Centre (AMC), Amsterdam, The Netherlands

A. van de Laar
Department of Surgery, Slotervaart Hospital, Amsterdam, The Netherlands
e-mail: Arnold.vandeLaar@slz.nl

C. Hinnen
Health Psychology Section, Department of Health Sciences, University Medical Centre Groningen, University of Groningen, Groningen, The Netherlands

Introduction

The amount of weight loss after gastric bypass surgery may depend to a large extent on the degree to which the patient succeeds in adopting healthy dietary recommendations [1]. Patients after gastric bypass surgery typically receive a number of diet recommendations such as to limit snacking and drinking soda [2]. Patients who failed to adhere to these recommendations lost less weight after a gastric bypass surgery [3], and patients who received early postoperative dietary counselling instead of standard postoperative care achieved greater weight loss after surgery [4].

Therefore, identifying the factors that could influence adherence to dietary recommendations after a gastric bypass operation is important. It may help to optimize the results of the operation. In accordance, a standard component of the clinical evaluation of candidates applying for bariatric surgery is a presurgical psychological assessment to identify possible indicators of suboptimal adherence and outcomes [5–8] [5, 9]. A history of psychological problems and current psychological problems (e.g. symptoms of anxiety and depression) have been found to be associated with a less positive evaluation of the eligibility of bariatric surgery candidates by psychologists [10] and with less weight loss after the initial year of the gastric bypass operation [11]. These relationships may be explained by the level of adherence to dietary recommendations, as those who were less adherent were found to have more psychological problems than those who did follow dietary recommendations more stringently [11].

In psychosocial development, early attachment experiences have been shown to have a profound influence on later emotional and social life and also on health behaviour and obesity. According to attachment theory, early childhood experiences that centre around the interaction with primary caregivers result in enduring expectations about the availability and responsiveness of others [12]. In adulthood, these attachment representations are reflected in mental states concerning *anxiety* about rejection and abandonment, and *avoidance* of intimacy and interdependence. Both attachment anxiety and attachment avoidance have been found to be related to poorer adherence to medical regimens in chronically ill patients [13, 14].

More anxiously attached patients have been consistently shown to be more prone to distress when confronted with stressors [15]. In stressful situations, people with high levels of attachment anxiety may view themselves unable to deal with the stressors and may rely on smoking, alcohol and high-caloric food to regulate their emotions [16–18]. In accordance, attachment anxiety has been found to be associated with obesity in both children and adults [18, 19]. Due to their high levels of distress and their tendency to rely on external and behavioural modulators of affect such as high-caloric food, more anxiously attached patients can be expected to find it

more difficult to adhere to dietary recommendations after bariatric surgery.

More avoidantly attached patients, on the other hand, tend to dismiss symptoms of distress and vulnerability [20]. They stress the importance of independence and self-reliance, are reluctant to seek support and feel uncomfortable trusting others, including health care providers [21, 22]. Due to their high level of self-reliance and low collaboration with health care providers, it can be expected that they will be less adherent to dietary recommendations after bariatric surgery as well.

Our previous cross-sectional study observed that—in addition to past and current psychological problems—one's attachment representations are associated with a less positive evaluation of the eligibility of bariatric surgery candidates by psychologists [10]. The present longitudinal study examines three hypotheses: first, that attachment anxiety and attachment avoidance—over and above current and past psychological problems—are associated with poor adherence to dietary recommendations; second, that poorer dietary adherence is associated with less weight reduction; and, third, that dietary adherence is a mediator of the relation between, on the one hand, attachment anxiety, attachment avoidance and current and past psychological problems and, on the other hand, weight reduction 1 year after gastric bypass surgery.

Materials and Methods

Study Sample

Included in the analyses were 105 patients with morbid obesity between 18 and 60 years of age who applied for a laparoscopic Roux-en-Y gastric bypass operation in Slotervaart Hospital between February and August 2012. The inclusion flow chart is presented in Fig. 1. Of the 310 patients who applied for bariatric screening, 190 were operated between April and December 2012 and 131 of these patients agreed to participate in this study. Eventually, 105 patients completed the study and 26 were lost to follow-up.

Procedures

All patients referred to the Slotervaart bariatric surgery clinic received presurgical multidisciplinary assessments by a dietician, internist, surgeon and a psychologist including self-report questionnaires, semi-structured interviews and assessments of weight and height (body mass index (BMI)), preoperative diet and exercise habits, co-morbidity and sociodemographics.

For this study, questionnaires to assess patients' attachment representations and previous and current psychological problems were added to the standard set of preoperative measures.

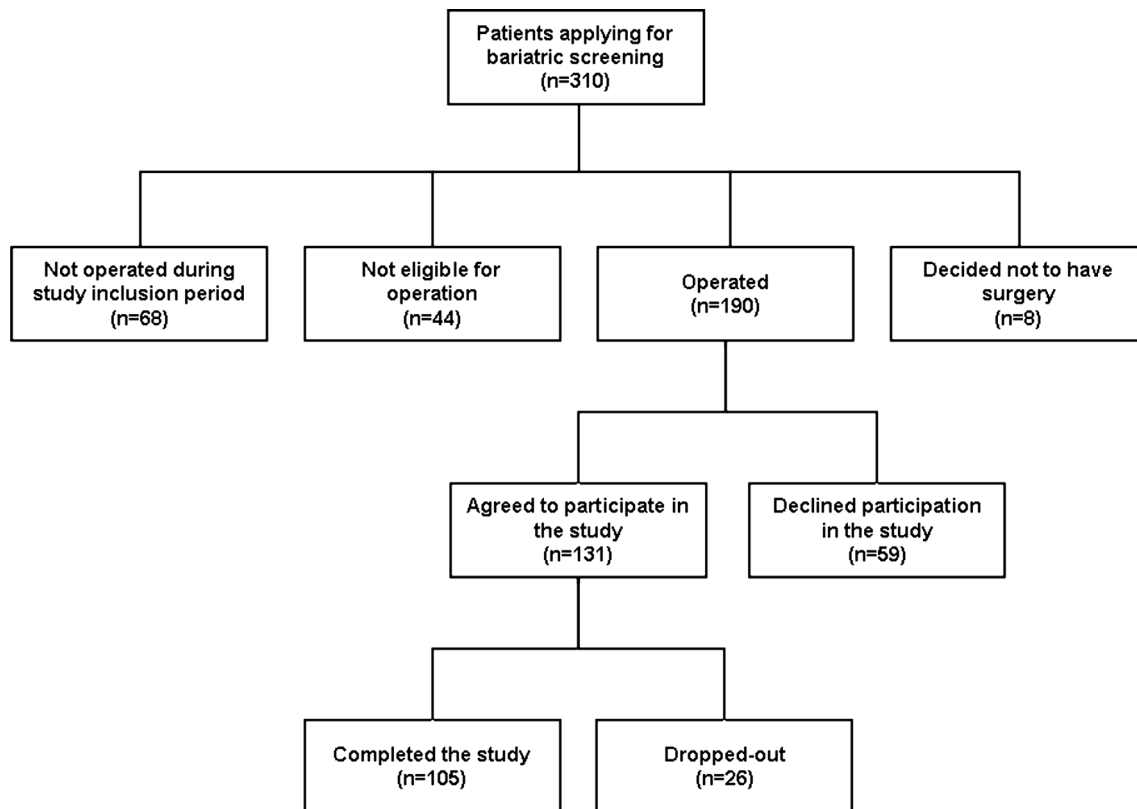


Fig. 1 Flowchart

At 6 and 12 months postoperatively, adherence to dietary recommendations and BMI was assessed. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Medical Ethical Committee of the Slotervaart Hospital. Informed consent was obtained from all participants.

Instruments

Patients' height and weight (without shoes) were measured in the hospital. Weight was measured at approximately the same time of the day, with the same pair of scales and rounded off to the nearest 0.1 kg. BMI was calculated by weight in kilograms divided by the square of the height in metres (kg/m^2).

Adherence to dietary recommendations was assessed using a single item with three possible responses: (a) "I generally followed the dietary recommendations", (b) "I almost followed the dietary recommendations" or (c) "I did not follow dietary recommendations".

Mental health history was assessed with a single item: "Have you ever been in contact with a social worker, psychologist or psychiatrist for professional help?" Response alternatives were "yes" and "no".

Current psychological problems were measured with the Hospital Anxiety and Depression Scale (HADS), which

consists of 14 items divided into two subscales. Seven items relate to anxiety (e.g. "I feel tense or wound up.") and seven items relate to depression (e.g. "I have lost interest in my appearance."). Each item has four descriptive response options to be scored on a scale of 0–3, with a value of 0 corresponding to "not exhibiting the symptom at all" and a value of 3 corresponding to "exhibiting the symptom to a high degree". Scores for each of the two subscales are derived by the summation of its seven items. If one or more of its items were missing, the subscale was disregarded. The lowest possible score for each subscale is 0 and the highest possible score for each subscale is 21. The developers have suggested that aggregate subscale scores of 0–7 represent non-cases, while scores of >8 on the subscale indicate that a current disorder warranting clinical attention may be present [23]. High internal consistency was found for both subscales of the HADS in this study: HADS-anxiety Cronbach's $\alpha=0.85$ and HADS-depression Cronbach's $\alpha=0.79$.

Adult attachment representations were assessed using the Experiences in Close Relationships-Revised Scale (ECR-R). The ECR-R is a 36-item self-report measure of adult attachment, which requires participants to reflect on their typical ways of relating in close relationships. Reviews of self-report measures of adult attachment suggest that the ECR-R has the best psychometric properties of the available measures [24].

The ECR consists of two continuous subscales, attachment anxiety (e.g. “I’m afraid that I will lose my partner’s love”) and attachment avoidance (e.g. “I prefer not to show a partner how I feel deep down”). Both dimensions are assessed with 18 items. Answers are on a 5-point scale ranging from “strongly disagree” (1) to “strongly agree” (5). In the present study, Cronbach’s alpha for subscale attachment anxiety was 0.88 and for subscale attachment avoidance 0.90.

Medical variables (e.g. hypertension, diabetes) were collected from patients’ medical records. Demographic variables (e.g. age, gender, marital status) at the first assessment were self-reported by the patients.

Statistical Analyses

Independent samples *t* tests, Pearson correlations and chi-square tests were used to determine which covariates had to be controlled for. A variable was considered a potential covariate in case of a correlation significant at $p < 0.10$.

Preliminary analysis showed that no patients reported not to have followed the dietary advices at all. Therefore, logistic regression analyses were performed with the outcomes: “I generally followed the dietary recommendations” and “I almost followed the dietary recommendations”.

In order to test the first hypothesis, univariate logistic regression analyses and forward logistic regression analyses were used.

To test the second hypothesis, multiple linear regression analyses were used, adjusted for baseline BMI. The percentage total weight loss (%TWL) was calculated as $(100 \times (\text{baseline BMI} - \text{BMI at 12 months}) / \text{baseline BMI})$.

Finally, to examine dietary adherence as a potential mediator of the association between the strongest predictor(s) of dietary adherence and weight loss (BMI at 12 months following surgery adjusted for baseline BMI), a bootstrapping resampling method with bias-corrected confidence estimates was done [25, 26]. In the present study, the 95 % bootstrap confidence interval of the indirect effects was calculated based on 5,000 bootstrap resamples [27, 28]. If the confidence interval does not overlap zero, the effect is said to be statistically significant. In all analyses, significance levels were set at $p < 0.05$. Data were analyzed using SPSS 19.

Results

Characteristics

Independent samples *t* test showed that patients who dropped out ($n=26$)—as compared to those who completed the study—scored higher on attachment anxiety [$t(124) = -11.979$, ($p < 0.001$), 95 % confidence interval (CI) = -2.34 ;

-1.66] and attachment avoidance [$t(126) = -3.139$, ($p = 0.002$), 95 % CI = -0.83 ; -1.19]. Drop-outs did not differ significantly on any other variables in this study.

Our study sample included 105 patients, predominantly female (81 %), with a mean age of 45 ± 9.1 years. Most patients lived with a partner (84 %) and were employed (76 %); about a quarter of the sample (27 %) had received higher education (bachelors’ degree or higher). Before surgery, mean weight was 123.7 ± 19.7 kg and mean BMI was 42.7 (6.1) kg/m^2 . Most of the patients underwent primary gastric bypass surgery (86 %), and 14 % of the patients had a revision gastric bypass surgery with removal of gastric banding during the same operation. All patients were operated laparoscopically.

Pearson correlations showed that the *p* value of the correlation between BMI at baseline and a younger age was < 0.10 : $r = -0.18$, $p = 0.06$. BMI was not significantly related to gender, diabetes, marital status, level of education and type of operation; these variables were excluded from further analyses.

For dietary adherence at 6 and 12 months after surgery, chi-square tests showed that patients with diabetes ($\chi^2 = 4.1$, $p = 0.04$) were less adherent to dietary recommendations. No other variables were found to be related to dietary adherence. At 6 and 12 months after surgery, 70 and 58 % of the patients reported to be adherent to their dietary recommendations, respectively. Table 1 shows the correlations between the five predictors in this study. Low to moderate correlations were observed between attachment representations and psychological problems.

Psychological Problems, Attachment and Dietary Adherence

Univariate logistic regression analyses, controlled for diabetes, showed that mental health history (odds ratio (OR) = 5.04, $p = 0.007$), current anxiety symptoms (OR = 1.16, $p = 0.03$), current depressive symptoms (OR = 1.18, $p = 0.02$) and attachment anxiety (OR = 4.76, $p < 0.001$)—but not attachment avoidance (OR = 1.63, $p = 0.13$)—were associated with dietary adherence at 6 months. Similarly, mental health history (OR = 3.29, $p = 0.01$) current anxiety symptoms (OR = 1.17, $p = 0.008$), current depressive symptoms (OR = 1.14, $p = 0.04$)

Table 1 Pearson correlations between the five predictors in the study

	1	2	3	4
1. Past psychological problems				
2. Current anxiety symptoms	13			
3. Current depressive symptoms	10	64***		
4. Attachment anxiety	44***	24*	34***	
5. Attachment avoidance	27**	37***	37**	49***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

and attachment anxiety ($OR=2.38, p=0.009$)—but not attachment avoidance ($OR=1.18, p=0.56$)—were associated with dietary adherence at 12 months. Forward logistic regression analyses showed that of these variables, attachment anxiety was the strongest predictor of dietary adherence at both 6 months (Nagelkerke $R^2=0.30, OR=4.92, p=0.009$) and 12 months (Nagelkerke $R^2=0.13, OR=2.61, p=0.006$).

Diet Adherence and Weight Loss

Multiple linear regression analyses, controlled for age and for baseline BMI, showed that poorer adherence to dietary recommendations at 6 months ($\beta=0.23, p=0.003$) was associated with less weight loss 12 months after surgery explaining 58 % of the variance. Patients who were adherent at 6 months showed a %TWL of 30.5 ± 6.5 , while patients who were less adherent to dietary recommendations showed a %TWL of 24.7 ± 6.5 in the first year following surgery. In contrast, no association was found between adherence to dietary recommendations at 12 months ($\beta=0.09, p=0.243$) and weight loss at 12 months.

Mediation Analysis of Attachment Anxiety, Dietary Adherence and Weight Loss

Attachment anxiety, the strongest predictor of dietary adherence, was examined in mediation analysis using the bootstrapping resampling method. Analyses adjusted for age and baseline BMI showed that dietary adherence at 6 months mediated the association between attachment anxiety and BMI ($\beta=0.51; 95\% CI=0.19-1.02$). Since there was no relationship between dietary adherence at 12 months and weight loss at 12 months, no mediating effect was found for dietary adherence at 12 months.

Conclusion

Attachment anxiety was observed to be a main predictor of poor dietary adherence. In addition, poor dietary adherence in the first 6 months after surgery showed an association with the amount of weight loss 1 year after the operation. Overall, we found support for the indirect effect of attachment anxiety on weight loss in the year following a gastric bypass operation, mediated by difficulty with adherence to dietary recommendations at 6 months.

Of the predictors that were examined in this study (mental health history, current psychological problems, attachment anxiety and attachment avoidance), attachment anxiety was found to be the strongest predictor of poor adherence to dietary recommendations. A possible explanation for this association can be found in the tendency of more anxiously

attached individuals to experience high levels of distress and to have problems with down-regulating their negative affect [29]. Eating can function as an emotion regulatory mechanism which may be especially persistent in more anxiously attached patients [30]. This notion is in accordance with previous studies showing an association between inadequate emotion regulation strategies and eating disorders [31–34]. A physiological mechanism may explain eating in response to stress and distress. Animal studies have shown that the consumption of high-caloric foods acts to calm the stress-perceiving areas of the brain [35–37] possibly by the release of oxytocin from the hypothalamus which has an anxiolytic effect [38]. Thus, high-caloric foods may help especially more anxiously attached individuals to down-regulate their high levels of distress, thereby obstructing adherence to dietary recommendations after gastric bypass surgery.

In contrast to expectations, no relationship was found between attachment avoidance and adherence to dietary recommendations. This may be explained by a differential way of coping between more anxious and more avoidantly attached individuals. While more anxiously attached patients respond to stressors in a hypervigilant manner, more avoidantly attached patients tend to respond by distancing, avoiding and repressing negative emotions [39–42]. Perhaps for some of them, negative emotions occur less often, or their self-reliant way of coping sometimes even helps them to follow dietary recommendations. Previous studies showing low adherence to medical regimen by more avoidantly attached patients took the quality of the patient-physician relationship into account [43]. That is, more avoidantly attached patients may show to be less adherent only when the relationship with the health care professional is less satisfying. Thus, although in some circumstances attachment avoidance may obstruct healthy eating behaviour, our results suggest that attachment avoidance per se is not a vulnerability factor to low dietary adherence after gastric bypass surgery.

Although there is no doubt that gastric bypass surgery is an effective treatment for the majority of patients with morbid obesity, our results indicate that the amount of weight loss after surgery will, to some extent, depend on the degree to which the patient succeeds in adopting healthy dietary recommendations in the first 6 months after surgery, which is in agreement with other reports [1, 3, 44]. However, no relationship was found between adherence to dietary recommendations at 12 months and postoperative weight reduction. This finding suggests that adherence to dietary recommendations is more predictive of future weight loss than of current weight loss. A future study with a design using more repeated measurements during a longer time interval is needed to examine this hypothesis.

A methodological asset of this study is the prospective design, but some weaker points should also be indicated. First, our data of attachment and dietary adherence were obtained by

self-report. Second, mental health history and dietary adherence were measured with single items which may have led to problems in measurement precision [45]. Moreover, future studies should preferably also include more objective measures of mental health history and dietary adherence. Third, dietary recommendations were not controlled in this study, that is, patients who showed more and less weight reduction postoperatively may have received more and less dietary advice. Fourth, results do not necessarily generalize to bariatric surgery patients as a whole or to patients subjected to other operations or with a still higher weight before surgery. Fifth, selection bias is suggested as drop-out rates in this study were higher for more anxiously and more avoidantly attached patients. Sixth, patients with a redo surgery were included as they failed in terms of successful weight loss after laparoscopic adjustable gastric banding; however, we did not find an association between type of surgery and weight loss or adherence to dietary recommendations in this study.

Finally, while a dimensional and self-report measure of attachment has theoretical and statistical advantages, the use of a categorical measure would have had clinical advantages [46]. In future studies, a categorical measure based on a more thorough investigation such as the adult attachment interview [47] may be considered [48]. A categorical measure makes it possible to further determine the relevance of considering attachment when designing interventions aimed at optimizing the result of a gastric bypass surgery.

In summary, in the year following a gastric bypass operation, more anxiously attached patients are indicated to have greater difficulty to adhere to dietary recommendations and consequently are at greater risk of not being able to profit fully from a gastric bypass operation.

Acknowledgments

Conflict of Interest Floor Aarts, Rinie Geenen, Victor E.A. Gerdes, Arnold van de Laar, Dees P.M. Brandjes and Chris Hinnen declare no conflict of interest.

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

Statement of Human and Animal Rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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