Predicting Outcomes Following Laparoscopic Adjustable Gastric Banding Surgery: Weight Loss versus Improved Perceptions of Appearance

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Abstract

Background: The number of overweight individuals continues to rise; some of these individuals require bariatric surgery to assist weight loss. In order to determine which individuals are most likely to benefit from surgery there is a need to know which factors predict success. To date, the focus of success has been on weight loss, but improvements in psychological factors are also important.

Method: A longitudinal study over five years with 73 participants having laparoscopic adjustable gastric banding [LAGB] surgery (58 female, 50 with diabetes, aged between 30 to 74 years (mean ± standard deviation, 46.3 ± 8.9). Scores from the Hospital Anxiety and Depression Scale [HADS], and Derriford Appearance Scale [DAS-24] were recorded along with participants' weight. Two separate linear regression analyses were performed to predict the 5 year outcomes for; a) DAS-24 scores, and b) Percentage Excess Body Weight Lost [%EBWL].

Results: Rates of social anxiety (DAS-24) were predicted by three variables; age group, pre-LAGB HADS anxiety and depression categories. %EBWL could not be predicted from the dependent variables (gender, age group, pre-LAGB BMI, pre-LAGB diabetic status, DAS-24 score at baseline, and the pre-LAGB HADS anxiety and depression categories).

Conclusion: Although the variables used in this study could not predict %EBWL following LAGB, rates of social anxiety associated with appearance (DAS-24) could be predicted by three variables. The DAS-24 findings highlight the importance of assessing an individual's mental health status prior to LAGB surgery.

Keywords

Laparoscopic Adjustable Gastric Banding; Outcomes; Longitudinal; Obesity; Prediction

Article Highlights

- Age group (aged ≤ 49 years or aged ≥ 50 years) is a significant predictor of emotional and behavioural problems (social anxiety and social avoidance related to appearance) as measured by the Derriford Appearance Scale [DAS-24] at five years post laparoscopic adjustable gastric banding surgery.

- Measures of general anxiety and depression in the form of the Hospital Anxiety and Depression Scale strengthen the prediction of the long term scores on the DAS-24.

- Assessing and addressing mental health problems prior to surgery would be beneficial in ensuring maximum long-term psychosocial benefits.

Introduction

A report published in 2017 using data collected between 1990 and 2015 stated that 603.7 million adults worldwide are considered obese [1]. To be classified as obese, individuals have to have a body mass index (BMI) ≥ 30 kg/m [2]. A large body of literature recognises that tackling obesity not just about reducing weight; outcomes such as improving mental health and self-perceptions are also important [1,3-6]. The preferred treatment for overcoming obesity is behavioural modification of an individual's maladaptive diet and exercise habits7-10, however, for some individuals bariatric surgery is an additional necessity to change food-related behaviours [2,8,11].

For many years the focus on outcome following bariatric surgery was weight loss, specifically individuals achieving > 50% excess body weight loss (EBWL) in the first two to three years following surgery [12]. EBWL < 20% was viewed as a failed surgical intervention [13]. However, evidence demonstrates that reducing EBWL by 5-10% can lead to significant reductions in the co-morbidities known to be associated with obesity such as cardiovascular disorders and diabetes, and for individuals who are obese these positive health benefits are unlikely to be achieved without surgical intervention [7,14,15]. More recently other positive outcomes in addition to weight loss have been considered as successes of bariatric surgery,

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such as improvement in quality of life, and improvements in mental health [3,5].

The ability to work out the factors that predict an outcome is a central feature of health research as it enables health care professionals to determine which individuals will benefit most from an intervention [16-19]. This is important for individuals undergoing bariatric surgery, as although this intervention is beneficial, it is expensive [15,20]. Factors shown to predict weight loss include; being aged < 40 years, and BMI < 50 kg/m2 prior to surgery, depression levels prior to surgery, and adherence to post-surgical eating guidelines [13,19,21]. Despite this knowledge there is still a requirement to further explore predictors of long-term success22, particularly in relation to issues of appearance related to obesity.

Overweight individuals are often stigmatised in society due to their appearance [23,24]. This stigmatisation often contributes to continued maladaptive behaviour, such as comfort eating, which can negatively impact on weight loss and maintenance [25,26]. Being visibly different creates challenges in activities such as using public seating (including within the workplace) and travelling by air, train or bus, as assistance is often required to adapt the environment [27-29]. Measurement of appearance difficulties and the impact on an individual is possible. One scale which explores the emotional and behavioural difficulties people experience due to appearance is the Derriford Appearance Scale [DAS-24] [30]. This scale is a shortened version of the DAS-59 [31]. Both scales have undergone rigorous psychometric testing during development. The advantage of the DAS-24 is the length of the scale when used as part of a battery of tests. In our own research we have used the DAS-24 to explore changes in perceptions of appearance following laparoscopic adjustable gastric banding [LAGB] surgery, both short-term (six months to one year following surgery) and longer-term (five years following surgery) [32,33]. Our findings indicate improvements are present following surgery, which are sustained long-term. However, to date, there are no published studies exploring what factors contribute to using this scale as a predictor of outcome. Therefore, the aims of the current research were two-fold. First, to explore predictors of emotional and behavioural difficulties due to problems with appearance using the DAS-24 scale, and second to explore predictors of %EBWL five years post-LAGB surgery in the current sample.

Method

Design

A prospective five year, single-centre longitudinal study.

Participants

Participants were recruited between 1st January 2007 and 31st December 2009 from a Weight Loss Service [WLS] in a National Health Service [NHS] hospital in the South West of England, United Kingdom [UK]. Seventy-three participants were recruited, of these 58 (79.5%) were female, and 50 (68.5%) were living with diabetes. Age at time of surgery ranged from 30 to 74 years (mean ± standard deviation [SD], 46.3 ± 8.9). One participant reported their ethnicity as Indian, while all others identified themselves as White. In order to receive LAGB surgery participants needed to meet the National Institute for Health and Care Excellence eligibility criteria [11].

Measures

At baseline participants were asked to record their demographic information (gender, age, and ethnicity). In addition the participants' diabetic status (living with diabetes or not) was recorded. At every visit, participants were weighed on calibrated scales, and completed two standardised measures. The DAS-24 consists of 24 items, with response options on a 4-point Likert scale ranging from 1 to 4. Response items vary between questions (e.g., "I avoid communal changing rooms" anchored from "almost always" to "never/almost never"; and "How rejected do you feel?" anchored from "not at all" to "extremely"), with 11 items having a "not applicable" [N/A] option scored as 0. Higher scores on the scale indicate higher levels of social anxiety associated with social avoidance as a result of

appearance concerns. There are no suggested clinical cut-offs for this questionnaire, but normative comparison values are given as 26.63 ± 11.40 (mean ± SD). The Hospital Anxiety and Depression Scale [HADS] comprises two subscales (seven items in each) measuring general anxiety and depression [34]. For this scale, respondents are asked to answer questions based on how they have been feeling in the past week, rated on a 4-point Likert scale ranging from 0 to 3. Response anchors vary between questions (e.g., "I can sit at ease and feel relaxed" anchored from "definitely" to "not at all"; and "I get sudden feelings of panic" anchored from "not at all" to "very much indeed"). Higher scores on the HADS indicate greater distress. The questionnaire authors suggest that scores are grouped to act as signifiers of distress. In its current form, the HADS is divided into four ranges: normal (0-7), mild (8-10), moderate (11-15), and severe (16-21).

Procedure

Ethical approval was obtained from North Bristol NHS Trust Research Ethics Committee [REC] (REC Ref: 06/Q2002/38). Written informed consent was obtained from all participants prior to study participation. Each data collection point typically coincided with the participant's routine visit at the WLS where they completed the study measures. If a participant did not attend, questionnaires were posted with a pre-paid envelope to enable return to the WLS.

Data Analysis

Analyses were undertaken using SPSS version [23]. Descriptive statistics (mean and SD) were calculated for every measure at each data collection point. Body Mass Index [BMI] and %EBWL was calculated for each participant at every visit using recommended methods [35,36]. Participants were assigned to dichotomous groups for age (aged ≤ 49 years or aged ≥ 50 years, n = 46 & 27 respectively) and BMI (≤ 49 kg/m2 or ≥ 50 kg/m2, n = 28 & 45 respectively), which are commonly used groupings in LAGB research [13,21,37,40,41]. In addition, participants were assigned to dichotomous categories for pre-LAGB levels of depression and anxiety (e.g., not depressed if the score was ≤ 7, or depressed if the score was ≥ 8 with the same cut-offs used for anxiety). As is typical in longitudinal studies, missing data was present, in these instances the last observation carried forward [LOCF] method was applied [42-44].

Linear regression analysis was performed. In the first regression the DAS-24 scores at five years post-LAGB was entered as the dependent variable, with gender, age group, pre-LAGB BMI and pre-LAGB diabetic status as the independent predictor variables on step one, with the pre-LAGB HADS anxiety and depression categories on step two [45,46]. In the second regression the %EBWL value at five years post-LAGB was entered as the dependent variable, with gender, age group, pre-LAGB BMI and pre-LAGB diabetic status as the independent predictor variables on step one, and the DAS-24 score at baseline, and the pre-LAGB HADS anxiety and depression categories on step two. Recommended techniques to test for multicollinearity were used [45].

Results

Missing Data

Table 1 shows the number of LOCF measures used at each time point for the DAS-24 and %EBWL measures. The information presented clearly shows that as time since surgery increases so does the amount of missing data. There is a larger percentage of missing DAS-24 data than weight data at each time point, suggesting participants found it more acceptable to be weighed than to fill in a questionnaire.

Regression

There were no issues with multicollinearity in either of the regressions as the Variance Inflation Factor [VIF] scores were below 10, and the average VIF score was not substantially greater than 1. Furthermore the tolerance scores were around 1 [45]. Table 2 shows the preoperative and five years post-LAGB scores for each of

Measure	6 months	1 year	18 months	2 years	3 years	4 years	5 years
DAS-24	11 (15.1)	14 (19.2)	18 (24.7)	22 (30.1)	22 (30.1)	28 (38.4)	33 (45.2)
% EBWL	0	10 (13.7)	4 (5.5)	6 (8.2)	9 (12.3)	21 (28.8)	26 (35.6)

Table 1: Number (%) of LOCF used at each time point post-LAGB surgery

Measure	Pre	5 years
DAS-24	63.2 ± 15.6	53.8 ± 18.9
% EBWL	-	33.9 ± 21.6
BMI	51.5 ± 8.6	41.2 ± 8.1

Table 2: Descriptive statistics (mean ± SD) of the measures preoperatively and five years post-LAGB

the measures. In addition, prior to surgery, 46 (63.0%) participants had signs of anxiety, and 44 (60.3%) had signs of depression (i.e. scoring more than 7 on the HADS subscales). A chi-squared analysis showed there were more participants experiencing both anxiety and depression prior to LAGB than individuals who were psychologically healthy; (49.3% versus 26.0% respectively), $\chi^2(1) = 16.8$, $p < 0.001$.

The results of the first regression with the DAS-24 as the dependent variable resulted in one predictor explaining 17.5% of the variance in step one ($R2 = 0.17$, $F(4,68) = 3.61$, $p = 0.01$). It was found that age group significantly predicted DAS-24 at five years post-LAGB ($\beta = -0.26$, $p = 0.03$). However, in step two, three predictors explained 49.2% of the variance ($R2 = 0.49$, $F(6,66) = 10.7$, $p < 0.001$). Age remained a significant predictor of social anxiety (DAS-24) at five years post-LAGB ($\beta = -0.21$, $p = 0.03$), with general anxiety ($\beta = 0.23$, $p = 0.03$), and depression strengthening the prediction ($\beta = 0.43$, $p < 0.001$). Using the constant and unstandardized β-values to calculate the relationship between the predictors and DAS-24 scores, results showed the predicted DAS-24 scores for participants aged ≤ 49 years are 8.1 points higher (i.e., they have more emotional and behavioural problems due to appearance) than participants aged ≥ 50 years five years post-LAGB. Similarly, participants who were experiencing symptoms of general anxiety (HADS) pre-LAGB have predicted DAS-24 scores 9.0 points higher five years post-LAGB than those who were healthy in this regard, while participants who were experiencing symptoms of depression (HADS) pre-LAGB have predicted DAS-24 scores 16.4 points higher five years post-LAGB than those whose scores on this HADS subscale were < 7.

In the second regression, with %EBWL as the dependent variable, in neither step one or two did any of the entered predictors explained the variance, $R2 = 0.02$, $F(4,68) = 1.3$, $p = 0.28$, and $R2 = 0.00$, $F(7,65) = 1.0$, $p = 0.44$, respectively.

Discussion

This exploration of the predictors of long-term appearance-related social anxiety (DAS-24) and %EBWL had mixed findings. The DAS-24 results showed that preoperative age group, and general anxiety and depression were all significant. Specifically, the presence of symptoms of general anxiety and depression prior to LAGB had a significant negative impact on the reduction of emotional and behavioural problems due to appearance five years following surgery. Additionally, individuals aged ≤ 49 years were more likely to still be experiencing social anxiety and social avoidance in the long-term than individuals aged ≥ 50 years, a finding reported during the development of the DAS-24 scale [30].

In terms of %EBWL, it appears that in the current sample the predictors used do not significantly explain the variance. In the five years post-LAGB this study was not able to predict the factors that are likely to be attributed to success, and we can see this sample on average did not achieve the 50% EBWL figure typically cited as expected for individuals post-LAGB [47]. However, five years post-LAGB the sample did have a sustained > 25% EBWL which should have positive long-term health benefits [47,48]. As far as the authors are aware, this the first time an exploration of the predictors of a

quantitative improvement in psychosocial functioning as it relates to the appearance aspects of obesity (as measured by the DAS-24) in a sample of individuals undergoing LAGB surgery has been undertaken.

Of note in this study is that gender was not a predictor of either DAS-24 or %EBWL. Females typically experience more emotional and behavioural problems due to appearance than males, along with depression as a result of obesity [45,49-51]. The absence of gender as a predictor may be due to the small unequal gender sample sizes, or the psychological predictors used in this study. For example, using a different psychological measure as the independent variable, such as personality, may have revealed gender as a predictor which has been demonstrated in research in a UK sample where results showed distinctly different relationships between men and women with regards to body weight and personality [52]. Furthermore, it is possible that the DAS-24 may not be sensitive enough to show known gender differences with regards to problems due to appearance in obese individuals. As far as the authors are aware this is the first time the DAS-24 has been used in this way, and further research would be required in a larger sample to validate these findings.

Findings from this study confirms previous research which indicate that the presence of anxiety and/or depression prior to LAGB surgery appears to have a lasting negative impact on mental health, as measured by the DAS-24 in the current study [22]. Furthermore, results indicate that an individual's mental health needs to be assessed, and if appropriate treated prior to and throughout their weight loss journey in order to maximise mental and physical health benefits from the surgical intervention [11,53,54]. Previous analysis on the current data set exploring changing in mental health over the five year period following surgery has indicated improvements from pre-surgical measurements [33,37,38].

It is an established fact that diabetes is a common co-morbidity in obese individuals [2,7,11]. Adherence to diabetes medication can influence weight control, which in turn affects appearance [39]. Over half the individual's in the current study were living with diabetes, yet this was not a predictor for either %EBWL or DAS-24 outcomes. Issues with appearance as measured by the DAS-24 are arguably unlikely to be related to diabetic status in adults, but in an adolescent sample this may be a predictive factor which would be worth exploring in future research.

Strengths and Limitations

In terms of the gender split within the current sample, this was typical of candidates for LAGB surgery with 80% generally being female, however, the skew towards a predominantly female sample makes the findings not necessarily generalizable to populations undergoing LAGB where there are more equal splits [40]. This is similar to the lack of ethnic minorities in the current sample, a point we have discussed elsewhere [33,37].

The sample size was small, however, guidelines suggest that a sample where n > 60 should be sufficient to identify predictors [45,55]. We can therefore cautiously assume that the factors that were significant predictors of the DAS-24 scores are likely to remain

in larger samples. The small sample may have been a contributing factor to the inability to find predictors of %EBWL. Another factor may have been the use of the LOCF method. The carried forward changes in DAS-24 may have been greater than the carried forward changes in %EBWL between time points, re-running the data with only those participants with a five year post-LAGB %EBWL recorded would not be reasonable as the sample would be n = 46 and therefore too small for regression analysis.

The missing data, although typical in longitudinal research, also may be indicative of another issue with participants in weight loss studies. At six months, missing data was present for the DAS-24 scale but not %EBWL suggesting participants may have attended the appointment but chose not to complete the questionnaire. As time since surgery increased, the number of missing DAS-24 questionnaires continued to be higher than %EBWL data. This may indicate that following LAGB participants are more concerned about their changes in weight rather than their changes in psychological health. These individuals are attending a WLS where the primary focus of their visits is on the amount of weight they are losing, however, it is well documented that psychological health is important for weight loss and maintenance [3,13,18,19,56]. It is possible that at routine post-surgery follow-up appointments the patient-clinician discussions are concentrating on behavioural changes required to lose weight, and psychological adaption following surgery may be overlooked.

Conclusions

The presence of anxiety and/or depression prior to LAGB surgery and the age group an individual belongs to are all predictive factors for the long-term improvements of social anxiety associated with appearance. However, %EBWL appears not to be predictable from the dependent measures used in the current study. These findings highlight the importance of assessing the mental health of individuals undergoing LAGB prior to surgery in order to support change if required to ensure maximum long-term benefits from surgical intervention.

Funding

Disclosure Statement

The authors declare no conflict of interest.

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