Relationships between a history of abuse, changes in BMI, physical health, and self-reported depression in female bariatric surgery patients

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ABSTRACT:

BACKGROUND/OBJECTIVES:

A history of physical and sexual abuse has been implicated in weight gain. While bariatric surgery is effective for weight loss in severely obese individuals, we investigated whether bariatric surgery patients who self-report a history of physical and/or sexual abuse have differential outcomes regarding weight loss, body mass index, quality of life (SF-36), and depressive symptoms (CESD) compared to non-abused patients.

METHODS:

Standardized assessments at baseline and follow-up visits were performed on 103 obese (BMI>35) female bariatric surgery patients (mean age: 44.11 years, SD: 11.67 years).

RESULTS:

49.5% of participants reported abuse. Abused group had significantly higher BMI ($p<0.01$) and depression scores ($p<0.1$). After surgery, the BMI between the two groups was no longer significantly different, though the abused group remained significantly more depressed. Mixed models showed that abuse was associated with CESD depression scores ($p<0.01$) and SF-36 mental composite scores ($p=0.03$) after adjusting for smoking history.

CONCLUSION:

Bariatric surgery leads to a better weight loss in abused patients. Abuse history might be an additional factor for clinicians to consider when advising bariatric surgery, as our

study suggests that women with history of abuse may have a higher weight loss benefit but less mental health improvement from the intervention.

INTRODUCTION

Due to failure of other weight loss interventions [1], bariatric surgery is commonly used by severely obese people with a history of abuse to achieve significant and sustainable weight loss. Current literature shows that childhood and adulthood physical and sexual abuse have drastic consequences on adult eating habits, and are highly correlated with excessive weight gain as well as destructive eating disorders, even when sociodemographic factors are taken into account [2, 3]. Those with morbid obesity are also two to three times more likely to have been victims of physical and/or sexual abuse in the past [4].With the prevalence of abuse among adults in the United States estimated to be between 15-27% [5], it is important to explore the effect of bariatric surgery on patients with history of abuse.

There is accumulating evidence that depressive symptoms are associated with severe obesity in adults [6]. The Swedish Obesity Study demonstrated that severely obese adults have increased rates of mood disorders and more severe self-reported depressive symptoms [7]. This effect might be stronger in female patients with a history of abuse, as Roosa et al. suggested that there may be a link between history of abuse and depression in women [8]. Obesity also has negative consequences on self-reported physical quality of life measured by SF-36 and other surveys [9].

Sustained reductions in depressive symptoms have been reported following bariatric surgery [10]. Major weight loss, achieved by improved diet, increased exercise, or bariatric

surgery, is strongly associated with higher quality of life with respect to both physical and mental scores measured by the SF-36 assessment and body image for people with severe obesity [11-13]. Despite high prevalence of mental disease and history of abuse in the bariatric surgery patients [4, 14], there have been few studies analyzing the associations between a history of physical and/or sexual trauma in the past and quality of life after the surgery. This line of research is especially important considering that psychological and psychiatric issues may result in denial of bariatric surgery in approximately 15% of patients [15].

The purpose of this study was to examine associations between abuse histories and weight loss as well as the SF-36 mental and physical composite scores, and the severity of depressive symptoms (CESD) after bariatric surgery. These measures are both highly validated and commonly used [16, 17]. This study would help to inform bariatric surgeons about change in body mass index (BMI), depressive symptoms, and quality of life among women with and without histories of abuse undergoing bariatric surgery.

MATERIALS AND METHODS

Participants and Settings

This study utilized data from two cohort studies of female bariatric surgery patients performed at Magee-Womens Research Institute, which followed the same inclusion criteria [18, 19]. These datasets were utilized because they included demographic information, health history, standardized surveys, and outcomes of the bariatric surgery patients collected in a standardized way using validated methods. A comparison of

recruited participant characteristics and demographics by history of abuse is described in **Table 1.**

Briefly, 103 women, with class II (35-40 kg/m^2) or class III obesity (> 40 kg/m^2), aged 18-72 (mean age: 44.11 years, SD: 11.67 years) completed baseline and 6-month follow-up assessments. The inclusion criteria for the parent studies included: confirmed approval for bariatric surgery (Roux-en-Y gastric bypass, laparoscopic gastric banding, or sleeve gastrectomy), life expectancy greater than three years, and at least one ovary [18-20]. The exclusion criteria for the parent studies included: refusal to sign informed consent, plans to become pregnant within a year, inability to attend the in person-visits for the study assessments, endometrial ablation, previous hysterectomy, severe inflammatory disease, recent surgery, or plans to change residence within a year. For the purpose of this investigation, inclusion criterion was completion of two study visits and completion of the abuse question. All participants signed informed consents. The University of Pittsburgh's Human Research Protection Office (HRPO) approved this study.

Outcome and predictor variables

Our primary outcomes (BMI, CESD depression score, and SF-36 physical and mental scores) were assessed before and after the bariatric surgery, and were used as repeated outcome variables in our mixed models.

Data on main predictor variables, including abuse, and smoking history, were self-reported by participants using the Screening Questionnaire for General Health History (SQH and SQHH). These validated questionnaires were previously used in both the

SMART and PREFER studies, in which behavioral weight management was examined [16, 17]. Abuse was self-reported as either present or not present in childhood and/or adulthood. Patient assessment visit (baseline and 6 month) was used as a predictor in mixed models.

Registered nurses and staff at the Clinical and Translational Research Center (CTRC) at Magee-Womens Hospital of UPMC obtained anthropometric measurements two to six weeks before surgery. BMI (kg/m^2) was determined using weights collected by a Tanita body composition analyzer (Model TBF-310, Tanita Corporation of America). Participants wore light clothing and no shoes during the measurements. BMI change was calculated by subtracting BMI value six months after the bariatric surgery from pre-surgery BMI. Percent excess weight loss (%EWL) was calculated as following:

$$\%EWL = \frac{(pre-surgery\ BMI - post-surgery\ BMI)}{(pre-surgery\ BMI - 25kg/m^2)}\ x\ 100$$

Depressive symptoms were assessed using the validated and widely used Self-Reported Center for Epidemiologic Studies Depression Short Scale (CESD) [21]. An cut-off point was then used to determine whether the participant met the criteria for clinically elevated depressive symptoms (CESD score >16) [21].

Physical and mental composite scores were assessed using the self-reported Medical Outcomes Questionnaire (MOS-SF-36, V2.9) [22]. SF-36 questionnaire contains eight subscales including general health perception, change in health, physical functioning, physical roles, emotional roles, social functioning, bodily pain, mental health, and vitality scores [22]. Physical and mental composite scores were calculated as functions of these eight subscales.

Statistical Analysis

Basic descriptive statistics were used to characterize the study populations. Demographic and personal characteristics were compared between abused and non-abused women using the Student's t-test and Wilcoxon Mann-Whitney U-test for continuous variables, and Chi-Square test and Fisher's exact test for categorical variables. Linear mixed models including repeated measures were performed to compare the effects of bariatric surgery on in BMI and EWL, CESD score, SF-36 physical score and mental composite scores. These models included time (baseline and 6 months) and abuse history, and were further adjusted for smoking history and interaction between effect of bariatric surgery and abuse. All statistical analyses were done with SAS version 9.4 (SAS Institute Inc., Cary, NC). The alpha level was set at 0.05 and was two-sided.

RESULTS

The comparisons of personal characteristics between the groups of abused and non-abused women are presented in Table 1. There were no significant differences in the basic characteristics of abused and non-abused women, except for smoking. More than half (58%) of the women in the abused group reported being former smokers compared to only one fifth (19.6%) of the non-abused group ($p<0.01$).

Table 2 shows the comparisons of BMI, Center for Epidemiological Studies Depression score, SF-36 physical and mental health characteristics of the participants in the abused and non-abused groups at the assessments before and after the bariatric surgery. Women in the abused group had significantly higher BMI compared to non-abused

women at both assessments (p=0.01), but benefited more from the surgery, as the abused group had a larger decrease in BMI with an average decrease of 12.1 as opposed to 9.4 for the non-abused group. This resulted in the abused group having a BMI that was not significantly different from the non-abused group (p=0.51) after bariatric surgery. %EWL was also not statistically significant between abused (58%) and non-abused (51.7%) groups (p=0.18).

The depression score was significantly different between abused (15, IQR 9,19) and non-abused women (8, IQR 3,12) (p<0.01). The abused group had larger improvement in their depression scores (6 points versus 3 points), but the change was not statistically significant (p=0.45). The abused group still had significantly higher depression scores after the surgery compared to the non-abused group (5 vs. 9) (p=0.02). In addition, there was a significant difference between the two groups in the number of participants self-reporting clinical levels of depressive symptoms (CESD scores ≥16) with the abused group having significantly higher number (p < 0.01). At the 6-month assessment, the abused group still reported significantly high number of depressive symptoms (p=0.03).

There were no significant differences in SF-36 physical score between abused and non-abused groups before and after bariatric surgery. The abused population also had significantly lower SF-36 mental health composite scores post-surgery (p=0.04), even though there was no significant difference in this variable before surgery.

Linear mixed models showed that assessment visit was significantly associated with BMI, CESD depression score, and SF-36 physical composite score over time adjusting for abuse, smoking history, and interaction between abuse and visit (Table 3). Abuse

and assessment time were significantly associated with BMI over time with abused women having a higher BMI by 2.57 ($p<0.01$) prior to surgery compared to other women after adjusting for abuse and smoking history. Women in the abused group were more depressed ($p<0.01$) compared to those in the non-abused group after adjusting for smoking history and abuse and visit interaction. A history of abuse was also significantly associated with SF-36 mental score, with the abused group having a lower score by 5.93 points ($p=0.03$) than the non-abused group after adjusting for smoking history and abuse and assessment time interaction.

DISCUSSION

This study is one of the first to explore the association between self-reported physical and/or sexual abuse and bariatric surgery outcomes. Half of the participants (49.5%) reported a history of abuse, which is slightly higher than that of other studies (approximately 25%) [23]. Women in the abused group had significantly higher BMI before, but not after the surgery; lost significantly more weight; and were more depressed compared to non-abused women. Mixed models showed that depression and SF-36 composite mental score were significantly worse in the abused group over time. This is consistent with prior literature that suggests high levels of psychological disturbances as well as psychiatric diagnoses possibly associated with a history of abuse in bariatric surgery candidates at baseline assessments [24, 25].

The abused and non-abused groups were similar in their demographic characteristics except the abused group was significantly more likely to have a history of smoking.

Since there is evidence of a correlation between severe stress and smoking being used as a coping mechanism [26], the correlation between former abuse and smoking is not surprising. Because smoking is linked to numerous health problems and leads to a decline in physical health over the long term, this factor should be further examined in the future studies. It is important to note that in order to qualify for the bariatric surgery at our institution, patients were not permitted to be current smokers. Therefore, there is a possibility that bariatric surgery patients underreported current tobacco use.

Patients who reported a history of abuse also had significantly higher BMIs before surgery. However, they also lost significantly more weight six months after surgery such that there was no significant difference between the groups' BMI after bariatric surgery, thus normalizing the abused population. Previous weight loss research reported mixed results; with some studies suggesting that prior abuse has no correlation with success in weight loss [23, 27, 28], while another reports positive correlations with weight loss as a result of surgery [29]. Since previous research demonstrates that surgical weight loss results in better psychological functioning after bariatric surgery compared to other weight loss interventions [30], one might anticipate that individuals with a history of abuse may particularly benefit from bariatric surgery.

CESD scores showed marked improvement from the baseline to six month assessment for both groups (Figure 2), which is consistent with prior studies dealing with mental health for female bariatric surgery candidates and quality of life [31-33]. However, CESD scores of the abuse group demonstrated higher levels of depressive symptomatology for both the baseline and six-month visits. Thus, those who reported abuse still exhibited more self-reported markers of poor mental health, despite losing a similar, or

in some cases, more weight. Research performed at another large medical center corroborates this finding, suggesting that initial weight and weight loss is not directly correlated with mental health score improvements [34]. This is particularly concerning, as poor mental health and more depressive symptoms have been closely linked to eating disorders and weight gain in the first place [35].

In concordance with previously published literature, we have found that bariatric surgery had positive effects on BMI, CESD depression score, and SF-36 physical composite score adjusting for abuse, smoking history, and interaction between abuse and assessment time (baseline and six months). Mixed models also showed that the abused group had higher BMI at baseline compared to the non-abused group, which aligns with published reports [36, 37]. Though bariatric surgery decreased depressive symptoms in both abused and non-abused women, abused women were still significantly more depressed than non-abused women, post-surgery. However, women in the abused group showed better improvement of the absolute change in the depression score suggesting that they benefit from the surgery.

Only female bariatric surgery candidates were included in the study; therefore, we do not know if our results can be generalized to males. Many studies on bariatric surgery do not dichotomize based on gender [38, 39], but because males and females react to abuse differently [40], such analysis is necessary to provide a complete picture in future research.

One of the strengths of the study is that the ethnic breakdown of our research sample closely mirrors the general population breakdown in the US and Allegheny County

where the study was conducted. According to the most recent census, African Americans and European Americans represent 13.3% and 77.1% of the population of the US, respectively [41]. Similar breakdown is observed in Allegheny County [42].

Another strength is the robust methodology, including the use of standardized SF-36 and CESD surveys, which are validated and commonly used instruments for this type of research.

There were limitations to this study, one of which was the modest sample size. A larger cohort might reveal more subtle associations. Another potential limitation is the fact that that we were not able to analyze the data by the type of bariatric surgery. It has been reported that laparoscopic gastric band surgery induces the slowest weight loss while the gastric sleeve surgery leads to the fastest weight loss [43]. This limitation will need to be addressed in future investigations with larger sample sizes.

Finally, since the questionnaires were self-reported, one limitation is the potential for response bias. Because participants may have wanted to present themselves in a favorable light, they may have underreported problems, which could potentially affect the CES-D and SF-36 scores.

Research on psychosocial outcomes following bariatric surgeries suggests that patients' lives typically follow the grounded theory methodology, in which patients experience a "rebirth" or "transformation" [24, 44]. Often, such patients characterize the two periods of before and after surgery as clearly dichotomous with more positive aspects associated with the after stage [45]. However, not all surgeries result in sustained weight loss, with some patients gaining most or even more of the weight back within a few years or

simply having unrealistic expectations of the surgery [46]. Because the current data deals only with baseline and 6-month assessments, it would be interesting to examine whether there are any marked differences between the formerly abused and not abused group for a longer follow-up time, which will be the focus of our future research.

Given the high cost of bariatric surgery and the possibility of complications, ensuring the best possible treatment plan customized to patients' personal characteristics is very important. Finally, if history of abuse is predictive of outcomes, the most effective type of clinical intervention needs to be determined by future research. In an era where precision medicine is rapidly becoming the norm [47], such research could aid in the development of new protocols, such as Adapted Motivational Interviewing [48], to treat such patients and potentially achieve better outcomes. Ultimately, the goal of such research is not to deter future patients from the surgery but rather to educate and perhaps provide interventions and recommendations to ensure the best possible outcomes of the surgery.

CONCLUSION

This study is one of the first to examine the correlation between a history of prior physical and sexual abuse in bariatric surgery patients and the results of bariatric surgery. Those who self-reported abuse tended to lose more weight six months postoperatively, but had worse mental health profiles both before the surgery and six months after.

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AUTHOR DISCLOSURE STATEMENT

The authors report no conflict of interest. No competing financial interests exist.

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Table 1: Comparison of demographic and personal characteristics by a history of abuse

	Total	History of abuse		P-value
	(n=103)	No (n=51)	Yes (n=50)	
Age (mean, SD)	44.1 (±11.7)	44.8 (±12.1)	43.8 (±11.4)	0.67 [a]
Race (n,%)				0.67 [b]
Caucasian	80 (78%)	39 (76.5%)	40 (80%)	
African American	23 (22%)	12 (23.5%)	10 (20%)	
Education level (n,%)				0.37 [b]
< high school or GED	53 (51%)	24 (47.1%)	28 (56%)	
college or higher	50 (49%)	27 (52.9%)	22 (44%)	
Employment status (n,%)				0.94 [b]
unemployed/disabled	37 (36%)	18 (35.3%)	18 (36%)	
employed	66 (64%)	33 (64.7%)	32 (64%)	
Smoking history (n,%)				<0.01 [b]
never smoker	63 (61%)	41 (80.4%)	21 (42%)	
former smoker	40 (39%)	10 (19.6%)	29 (58%)	
History of menopause (n,%)				0.83 [b]
no	67 (65%)	33 (66%)	32 (49%)	
yes	35 (34%)	17 (34%)	18 (51%)	

[a] Student's t-test

[b] Chi-square test

*SD = Standard deviation

Table 2: Comparison of physical and mental health characteristics by a history of abuse

	Total	History of abuse		P-value
	(n=103)	No (n=51)	Yes (n=50)	
BMI (mean, SD)				
Pre-surgery	45.3 (±6.2)	43.6 (±4.5)	46.8 (±7.3)	0.01 [a]
Post-surgery	34.5 (±5.6)	34.1 (±5)	34.8 (±6.3)	0.51 [a]
BMI change	10.8 (±4.7)	9.4 (±4.4)	12.1 (±4.5)	<.01 [a]
Excess Weight Loss (%)	54.8 (±23.5)	51.7 (±24.4)	58 (±22.4)	0.18
Depression score (median, IQR)				
Pre-surgery	10 (IQR 5,18)	8 (IQR 3,12)	15 (IQR 9,19)	<.01 [c]
Post-surgery	8 (IQR 3,14)	5 (IQR 2,11)	9 (IQR 4,18)	0.02 [c]
Depression score change (mean, SD)	-1.8 (±9.2)	-1.2 (±7.8)	-2.7 (±10.7)	0.45 [a]
Clinical levels of depression, pre-surgery (n,%)				<.01 [b]
No	73 (71%)	44 (86.3%)	28 (56%)	

Yes	30 (29%)	7 (13.7%)	22 (44%)	
Clinical levels of depression, post-surgery (n,%)				0.03 [b]
No	77 (75%)	43 (88%)	33 (70%)	
Yes	21 (20%)	6 (12%)	14 (30%)	
Physical composite score (median, IQR)				
Pre-surgery	43.7 (IQR 34.4,50.1)	49 (44, IQR 35, 51)	49 (43, IQR 34,48)	0.10 [c]
Post-surgery	52.8 (IQR 46.1,56.3)	49 (53, IQR 48,57)	47 (53, IQR 45,55)	0.46 [c]
Physical composite score change (median, IQR)	8.5 (±10.2)	7.2 (±8.5)	9.8 (±12)	0.23 [a]
Mental health composite score (median, IQR)				
Pre-surgery	53.2 (IQR 42.2,57.2)	49 (55, IQR 48,58)	49 (49, IQR 41,56)	0.10 [c]

Post-surgery	53.8 (IQR 45.9,58.2)	49 (56, IQR 50,59)	47 (53, IQR 42,57)	0.04 [c]
Mental health composite score change (mean, SD)	9.5 (±15.8)	10.1 (±16.4)	9.1 (±15.3)	0.78 [a]

[a] Student's t-test

[b] Chi-square test

[c] Wilcoxon Mann-Whiney U-test

[d] Fisher's exact test

*BMI = Body Mass index; SD = Standard deviation; IQR = Interquartile Range

Table 3. Mixed models for in BMI, Depression score, Physical composite score, and Mental composite score between pre- and post-surgery after adjusting for abuse, smoking history, and interaction between abuse and visit [a]

Variable	p-value	p-value	p-value	p-value
BMI				
Visit	<.01	<.01	<.01	<.01
Abuse		0.14	0.27	0.19
Smoking history			0.52	0.51
Abuse*Visit				<.01
Depression score(CESD)				
Visit	0.04	0.03	0.03	0.03
Abuse		<.01	<.01	<.01
Smoking history			0.15	0.15
Abuse*Visit				0.54
Physical composite score(SF-36)				
Visit	<.01	<.01	<.01	<.01
Abuse		0.20	0.21	0.18
Smoking history			0.82	0.23
Abuse*Visit				0.84
Mental composite score (SF-36)				

Visit	0.14	0.12	0.11	0.11
Abuse		0.10	0.02	0.03
Smoking history			0.06	0.06
Abuse*Visit				0.33

[a] Mixed modeling was used to analyze each of the outcome models. Adjustments for abuse, smoking history, and interaction about abuse and visit were adjusted for, in that order.

*BMI = Body Mass index; CESD = Center for Epidemiologic Studies Depression Scale; SF-36 = 36-Item Short Form Health Survey