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Depressive symptoms before and after abdominoplasty among post-bariatric patients – a cohort study

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ABSTRACT

The majority of post-bariatric patients suffer from excess skin after weight loss, impairing physical, psychosocial and mental health. The abdomen is the most common location for excess skin, and abdominoplasty is the most commonly required reconstructive procedure. Abdominoplasty removes excess abdominal skin and attenuates related symptoms, but knowledge regarding mental health-related effects is scarce. Here, we aimed to evaluate the symptoms and severity of depression before and after abdominoplasty in post-bariatric patients and to analyse the relationships between depressive symptoms, quality of life (QoL) and experience of excess skin. We enrolled 110 former obese patients undergoing abdominoplasty. Three questionnaires evaluating the symptoms of depression (Beck Depression Inventory (BDI-II)), experience of excess skin (Sahlgrenska Excess Skin Questionnaire (SESQ)) and QoL (36-item Short-Form Health Survey (SF-36)) were completed preoperatively and 1 year postoperatively. After abdominoplasty, symptoms of depression (BDI sum score) significantly decreased (5.8 vs. 3.0, $p = .037$). Scores on three BDI questions improved ($p < .05$), and the SESQ score normalised ($p < .001$), while the SF-36 score was unaffected. The BDI sum score was moderately correlated with the SF-36 mental composite score (preoperatively, $r_s = -0.69$; postoperatively, $r_s = -0.66$) and fairly correlated with the SF-36 physical composite score ($r_s = 0.32$, $r_s = 0.26$). The correlation between the BDI sum and SESQ scores was poor preoperatively ($r_s = -0.106$) and fair postoperatively ($r_s = 0.232$). The results indicate that abdominoplasty may reduce symptoms of depression in post-bariatric patients. However, the procedure did not affect SF-36 scores. Further studies are required to validate these results.

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Introduction

It is well known that a large number of patients receiving bariatric surgery suffer from mental health disorders, particularly depression and binge eating disorders [1,2]. Surgical treatment of obesity is an effective and durable solution for weight loss when diets and other treatments fail. Weight reduction improves weight-related somatic comorbidities, increases physical health-related quality of life (QoL) and improves long-term survival [3–6].

Post-bariatric patients may have unrealistic expectations regarding the outcome of surgical treatment, which could lead to psychological issues, such as body image dissatisfaction due to excess skin. In addition, unresolved familial, occupational and social conflicts as well as childhood maltreatment and perception of unsatisfactory social support may play role in the outcomes following surgery [7–9].

In previous studies, it has been concluded that patients undergoing bariatric surgery benefit from weight loss and a reduction in the severity of weight-related somatic disorders [10]. Improvements in depressive symptoms have been reported after bariatric surgery and concomitant weight loss, but some patients

have been found to be at a risk of new onset depression and even suicide [11–14].

Massive weight loss results in excess skin on the abdomen, breasts and limbs, resulting in an older appearance [15,16]. The flapping of excess skin is disturbing during physical activities, and skin folds have a high risk of being sites for infections. Thus, the problems associated with excess skin are physical, psychosocial and psychological [17]. Whether these psychological problems can induce or worsen depression is yet to be clarified. In recent years, some studies have suggested that the removal of excess skin through abdominoplasty not only attenuates the specific problems related to excess skin on the abdomen but also improves QoL, especially in terms of the mental health components [18]. Patients with a desire for body contouring surgery (BCS) assign significantly lower scores to appearance and body image satisfaction and exhibit more severe depressive symptoms than patients without a desire for BCS [18,19]. The primary aim of the present study was to evaluate the symptoms and severity of depression before and after abdominoplasty in post-bariatric patients and to analyse the relationship between depression resulting from the experience of excess skin and QoL.

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Table 1. Patient characteristics.

	At inclusion <i>n</i> = 110
Age, years	43.6 (21.5–68.1)
Female gender, <i>n</i>	97 (88%)
BMI, (kg/m ²)	26.8 (21.2–30.6)
Weight loss, kg	44.5 (19–100)
Resection weight, g	1770 (200–4700)

Values are median (min–max), or *n* (%).

Materials and methods

Patients

This study is a part of a prospective randomised controlled study including 117 post-bariatric patients who were undergoing abdominoplasty between 2008 and 2012 [18]. Among these patients, 110 (14 men and 96 women; mean age, 43.6 years) completed the questionnaires described below before and one year after abdominoplasty. The non-response rate was 5.9%. The patient characteristics are presented in Table 1. None of the patients had undergone any other reconstructive surgeries before or during participation in the study.

Questionnaires

Beck Depression Inventory (BDI)

Symptoms and severity of depression were assessed using the BDI. The BDI-I was introduced in the 1960s and consists of 21 questions regarding the subjective symptoms of depression [20]. After the diagnostic criteria for depression were updated, the BDI-II was introduced in 1996. In this study, the updated version [21] was administered to the participants before and one year after reconstructive abdominal surgery. The questionnaire is a 21-item self-rated scale that evaluates the presence of symptoms and severity of depression. Each item receives a score of 0–3, with higher scores indicating more severe symptoms. The results for each question as well as the BDI sum score (total score range, 0–63) are recorded. In this study, a five-grade scale was used to classify the patients as follows: grade 0 (score, 0), no depressive symptoms at all; grade 1 (scores, 1–13), minimal depressive symptoms; grade 2 (scores, 14–19), mild depressive symptoms; grade 3 (scores, 20–28), moderate depressive symptoms; and grade 4 (scores ≥ 29), severe depressive symptoms. Thus, grades 0–4 were used.

Sahlgrenska Excess Skin Questionnaire (SESQ)

The patient's experience of excess skin is assessed using the SESQ [22]. Therefore, the SESQ score was used in this trial. This questionnaire is based on seven symptoms related to excess skin after weight loss, which are rated from 0 ('never') to 4 ('all the time'):

- 'My excess skin is causing itching and rash.'
- 'My excess skin makes it difficult to run/walk fast.'
- 'My excess skin makes it difficult to find clothes that fit.'
- 'My excess skin hinders me in everyday life.'
- 'My excess skin hinders me in intimate situations.'
- 'My excess skin makes it difficult with personal hygiene.'
- 'My body is unattractive because of my excess skin.'

The SESQ score is the sum of the scores of each question and ranges from 0 to 28, with higher scores indicating a higher degree of perceived problems. The score is reliable and has been validated to the questionnaire BODY-Q [23].

The 36-item Short-Form Health Survey (SF-36)

This questionnaire evaluates general health and consists of eight scaled domains: vitality, physical functioning, bodily pain, general health perceptions, physical role functioning, emotional role functioning, social role functioning and mental health [24,25]. The total scores are the weighted sums of the scores assigned to the responses in each domain. Scores range from 0 to 100, with lower scores indicating a higher level of disability and higher scores indicating a lower level of disability. Two summary scores can be calculated: the mental component score (MCS) and physical component score (PCS).

Ethics and statistics

The Local Ethics Committee in Gothenburg, Sweden, approved this study (DNR 723-08). The patients participated after being provided with oral and written information and after written informed consent was obtained.

The results of the trial are presented as mean and standard deviation or median (min–max) when appropriate. Comparisons between the variables before and after surgery were made using Wilcoxon's signed-rank test. Correlations between variables were analysed using Spearman's rank correlation test. Correlations were defined as poor ($r > 0.20$), fair ($r = 0.21$ – 0.40), moderate ($r = 0.41$ – 0.60), good ($r = 0.61$ – 0.80) and very good ($r = 0.81$ – 1.00) [26]. Statistical significance was set at $p < .05$.

Results

The BDI-II, SESQ and SF-36 scores are presented in Table 2. The patients reported a significantly lower degree of depression postoperatively (BDI sum score, 5.8 vs. 3.0; $p = .037$) (Table 3). The scores of three of the questions included in the BDI were significantly different postoperatively (improved symptoms: 'feelings of worthlessness', $p = .001$; 'concentration difficulty', $p = .001$; and worsened symptoms: 'irritability', $p = .025$). Both men and women reported a significantly reduced symptoms of depression after abdominoplasty ($p = .018$ and $p < .001$, respectively), but there were no statistically significant differences between the genders ($p > .05$).

Significantly lower scores were assigned to the symptoms related to excess skin postoperatively ($p < .001$), but there were no significant changes in the QoL, MCS ($p = .776$), or PCS ($p = .284$) in this study group.

Table 3 presents the distribution of patients by BDI grades 0–4 based on their scores before and after abdominoplasty. Of the 110 examined patients, 39 reported an improvement in symptoms after surgery, and 18 indicated that their symptoms worsened. The change in grade is statistically significant ($p = .001$). Difference in symptoms of the 14 patients who had moderate and severe symptoms preoperatively (grades 3–4) were also significant ($p < .001$). Three of them had similar symptoms as postoperatively and one graded worse symptoms (from moderate to severe). Of the remaining 10 patients seven improved one grade and three improved 2–3 grades.

The correlation between the BDI sum and SESQ scores was poor preoperatively ($r_s = -0.106$) and fair postoperatively ($r_s = 0.232$). The BDI sum score exhibited a moderate correlation with the SF-36 MCS ($r_s = -0.69$ preoperatively and $r_s = -0.66$ postoperatively) and a fair correlation with the SF-36 PCS ($r_s = 0.32$ and $r_s = 0.26$).

Table 2. Effect of abdominoplasty on BDI (items 1–21), BDI sum, SESQ score and SF-36 (mental component score and physical component score).

		Preoperatively	Postoperatively 1 year	<i>p</i> Value
BDI	(1) Sadness	0.37 (0.70) 0 [0–3]	0.36 (0.67) 0 [0–3]	.899
	(2) Pessimism	0.34 (0.55) 0 [0–2]	0.35 (0.66) 0 [0–3]	.984
	(3) Past failure	0.33 (0.60) 0 [0–3]	0.35 (0.72) 0 [0–3]	.756
	(4) Loss of satisfaction	0.38 (0.59) 0 [0–3]	0.32 (0.59) 0 [0–3]	.254
	(5) Guilty feelings	0.35 (0.68) 0 [0–3]	0.25 (0.57) 0 [0–2]	.148
	(6) Punishment feelings	0.22 (0.63) [0–3]	0.25 (0.57) 0 [0–3]	.456
	(7) Self-dislike	0.51 (0.72) 0 [0–3]	0.37 (0.65) 0 [0–3]	.065
	(8) Self-criticism	0.49 (0.64) 0 [0–2]	0.45 (0.70) 0 [0–3]	.452
	(9) Suicidal thoughts or wishes	0.08 (0.30) 0 [0–2]	0.14 (0.44) 0 [0–3]	.094
	(10) Crying	0.24 (0.59) 0 [0–3]	0.21 (0.51) 0 [0–3]	.545
	(11) Agitation	0.49 (0.66) 0 [0–3]	0.37 (0.62) 0 [0–2]	.101
	(12) Loss of interest	0.26 (0.48) 0 [0–2]	0.35 (0.61) 0 [0–2]	.123
	(13) Indecision	0.29 (0.53) 0 [0–2]	0.35 (0.67) 0 [0–3]	.339
	(14) Feelings of worthlessness	0.75 (0.99) 0 [0–3]	0.43 (0.82) 0 [0–3]	.001***
	(15) Loss of energy	0.33 (0.68) 0 [0–3]	0.37 (0.72) 0 [0–3]	.504
	(16) Changes in sleeping pattern	0.48 (0.67) 0 [0–3]	0.55 (0.84) 0 [0–3]	.407
	(17) Irritability	0.41 (0.60) 0 [0–2]	0.56 (0.78) 0 [0–3]	.025*
	(18) Changes in appetite	0.23 (0.52) 0 [0–3]	0.22 (0.58) 0 [0–3]	.753
	(19) Concentration difficulty	0.78 (1.21) 0 [0–3]	0.29 (0.77) 0 [0–3]	.001***
	(20) Tiredness or fatigue	0.39 (0.70) 0 [0–3]	0.40 (0.76) 0 [0–3]	.804
	(21) Loss of interest in sex	0.86 (1.06) 0 [0–3]	0.68 (1.08) 0 [0–3]	.150
BDI sum (0–63)		8.56 (8.80) 5.8 [0–43]	7.55 (10.24) 3.0 [0–50]	.037*
Grade		1.30 (0.93) 1 [0–4]	1.08 (1.04) 1 [0–4]	.001
SESQ	SESQ score (0–28)	16.5 (5.9) 17 [1–28]	2.4 (5.1) 0 [0–28]	.001***
SF-36	Mental composite score	45.1 (13.2) 49.5 [9–64]	45.7 (14.1) 52.1 [7–63]	.776
	Physical composite score	48.6 (10.2) 52.0 [12–67]	48.8 (11.4) 52.6 [11–66]	.284

Values are mean (SD), median [min–max]. BDI score is given from 0 to 4 (0 = none; 1 = minimal; 2 = light; 3 = moderate; 4 = severe).

*Significant at <.05.

***Significant at <.001.

Discussion

The results of the present study indicate that depressive symptoms may diminish after abdominoplasty in post-bariatric patients. These results are based on prospectively collected data from 110 patients who completed three questionnaires before and 1 year after surgery. To the best of our knowledge, this is the first study to indicate that reconstructive surgery, when performed after bariatric surgery, may have an effect on depressive symptoms. This information is important when screening patients with excess abdominal skin who are seeking reconstructive surgery after massive weight loss. However, even if the difference is statistically

significant, the difference of 2.8 in score is below five-point difference which has been found to be the minimally important clinical difference of BDI-II in cross-cultural studies [27]. The difference in grade of symptoms is though significant ($p = .001$).

Obese patients who have been treated with bariatric surgery and have undergone concomitant massive weight loss are reported to be at a higher risk of both suicide and non-fatal self-harm compared with the general population [28,29]. The reason for this has not yet been clarified, but some proposed explanations include a sense of disappointment because of insufficient weight loss or because the surgery did not have as great a life-changing effect as expected [30]. Other reasons may be

Table 3. The effect of abdominoplasty on BDI grades.

		BDI grade after abdominoplasty					Total
		0	1	2	3	4	
BDI before abdominoplasty	0	6	1	5	0	0	12
	1	2	2	5	1	2	12
	2	22	5	42	2	1	72
	3	1	1	5	1	1	9
	4	0	1	0	2	2	5
Total		31	11	57	6	6	110

Crosstabulation shows the number of patients scoring from 0 to 4 (grade 0 = none, grade 1 = minimal, grade 2 = light, grade 3 = moderate, grade 4 = severe). Green colour marks patients with lower depression, yellow colour marks increased depression and the uncoloured marks no change.

BDI grade 0 (score 0), grade 1 (score 1–13), grade 2 (score 14–19), grade 3 (score 20–28) and grade 4 (score 29–63).

neuroendocrine alterations and maladaptive eating suggesting metabolic genesis [31]. Reasons that are psychological in origin, such as dissatisfaction with the body's appearance or excess skin and low self-esteem, have also been proposed [32].

Depression is a common and serious medical condition. It affects the ability to function both at work and at home [33]. To establish a diagnosis of depression, several conditions or symptoms must be present. The BDI is a commonly used instrument to screen patients for depression and to evaluate its severity and depth [21]. The present results show that depressive symptoms are common among post-bariatric patients, with 78% of the patients in our study group being assigned grades 2–4. Of the 110 patients, 39 reported an improvement in the symptoms of depression after abdominoplasty compared with 18 who reported worse symptoms. At the group level, the symptoms were attenuated after surgery; however, at the individual level, there may still be patients who experience a worsening of symptoms, similar to the 18 patients in our study. In our study, moderate to severe depressive symptoms (grades 3–4) were recorded in 14 patients before abdominoplasty and 12 patients after abdominoplasty. The most pronounced effects were found in the case of grades 2–0 (mild to no symptoms); specifically, there were 72 patients with grade 2 symptoms before abdominoplasty and 57 after abdominoplasty, and there were 12 patients with grade 0 symptoms before abdominoplasty and 31 after abdominoplasty. The results reveal that surgery had the greatest effect on patients with milder depressive symptoms, who moved from grade 2 to grade 1 or from grade 1 to grade 0. To our knowledge, no other studies have analysed the effect of abdominoplasty on the symptoms of depression in post-bariatric patients using the BDI. However, the relationship between psychological outcomes and surgery is not linear. Psychological outcomes are complex and must be controlled by several background variables to increase the probability of evaluating impact of surgery.

Saariniemi et al. [34] published a prospective study on patients undergoing aesthetic abdominoplasty, showing a significant reduction in the BDI depression score. However, Stuerz et al. [35] reported no significant change in anxiety or depression using the Hospital Anxiety and Depression Scale (HADS) [36]. In contrast to our prospective study of 110 patients, their study group consisted of only 26 patients, and they used a different instrument to measure anxiety and depression. Both the BDI and HADS are self-administered. The HADS is an instrument used to screen for the presence of possible anxiety or depression, whereas the BDI is used to evaluate the severity and depth of depression. Further studies are required for evaluating if and how post-bariatric patients with known depressive symptoms benefit from abdominoplasty. The severity of depression, evaluated by the BDI sum

score, was significantly reduced postoperatively although significant postoperative reductions were only found in the scores of three out of 21 questions. These three questions were number 14 ('feelings of worthlessness'), number 17 ('irritability') and number 19 ('concentration difficulty'). These findings are interesting to explore further. The improvement in 'feelings of worthlessness' is potentially related to the reduction in the excess abdominal skin and experience of having a more attractive body after abdominoplasty, which is a dimension evaluated by the SESQ. Hanging skin deviates from the aesthetic norms and causes problems, such as fungal infections, itching and bad odour. The changes in 'concentration difficulty' and 'irritability' are not obvious to interpret in relation to abdominoplasty. It is well known that women report on experiencing more side effects related to excess skin after massive weight loss than men [17]. The group of men in this study was small ($n=14$) compared to that of women ($n=96$). Both groups exhibited significant improvements in depressive symptoms. We found no significant differences between the sexes in terms of the BDI sum score postoperatively; however, on distributing the participants by the grade of depression, we found that men exhibited a greater degree of improvement than women (not presented in the results). The women had a significantly lower BDI sum score and degree of depressive symptoms postoperatively compared to preoperatively. The unequal groups limit the possibility of deeper analyses.

No correlation was found between age and changes in BDI scores ($r_s=0.094$, $p=.314$). Weight loss is often very significant during the first 1 or 2 years following bariatric surgery, [37] and this causes new and unexpected problems related to excess skin in the majority of patients, excess skin affects most of the body, but it is most pronounced on the abdomen, inner thighs, breasts and upper arms [38]. Apart from cosmetic concerns, excess skin causes secondary conditions, such as dermatitis, irritation and rash within the skin folds, and impaired activities of daily living [39]. These may be categorised as symptoms of a functional nature, which are directly related to excess skin. However, the relationship between excess skin and mental health in post-bariatric patients is still unclear. The results of this study reveal a poor correlation between the BDI sum score and SESQ score before abdominoplasty and a fair correlation postoperatively. The patients in this study also assessed their QoL before and after abdominoplasty; however, there were no significant differences in either the PCS or MCS. To further analyse the data, a correlation analysis was performed between the severity of depressive symptoms and QoL. The correlation between the BDI sum and SF-36 scores was fair to moderate both pre- and postoperatively. The moderate correlation of the BDI sum score with the MCS was stronger than that with the PCS, which supports the view that depressive symptoms are related to mental health aspects.

In this prospective study, patients were assessed pre- and postoperatively. A strength of this study is that the prospective approach limits the risk of failing to recall and that there was a very low drop-out rate. There may though be a risk of bias because of the association between the high participation and the offered treatment. However, also patients who did not want to participate would have undergone surgery during the study period. A non-participation did not lead to a longer time until surgery. Another advantage is that the surgery was performed at a single centre by following the same surgical protocol, which implies that the patients were operated in the same way, although there were several surgeons involved. However, another perspective is that the results of a single-centre study may be limited in terms of generalisability. It is also a limitation that we did

not include questionnaires about other aspects as body image dissatisfaction and that the patients did not fill in the questionnaires already before the bariatric surgery. Future trials may follow the patients from obesity, through weight loss to reconstructive surgery and the postoperative follow-up. It also would be of interest to also include a utility scale such as the Euro-QoL to be able to provide QALYs and economic evaluations comparing approaches to abdominoplasty in post-bariatric patients. In addition, with multiple analyses there is a risk of mass-significance, and the results have to be interpreted with that in mind.

In conclusion, the results indicate that abdominoplasty may reduce symptoms of depression in post-bariatric patients. However, the procedure did not affect SF-36 scores. Further well-designed studies are required to confirm whether abdominoplasty could treat/reduce depressive symptoms in post-bariatric patients.

Disclosure statement

No potential competing interest was reported by the authors.

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