Complications after Body Contouring Surgery in Post-Bariatric Patients: The Importance of a Stable Weight Close to Normal

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Keywords

Obesity · Body contouring surgery · Complications

Summary

Objective: Body contouring surgery is in high demand following the increase in bariatric surgery. Massive weight loss leads to an excess of lax, overstretched skin causing physical and psychosocial discomfort. Plastic surgical procedures can give rise to an improvement in quality of life, but the relative high complication rate could negatively affect these potential gains. The purpose of this study is to identify predictors of complications in order to optimize outcomes in this patient population. **Methods:** Out of a group of 465 post-bariatric patients, 61 patients underwent body contouring surgery following massive weight loss. A total of 43 respondents were reviewed retrospectively for demographic data, pre- and post-operative weight status and co-morbidities. Medical complications were categorized according to the modified Clavien classification. All cases were analyzed for risk factors. **Results:** A stable weight over a period of at least 3 months prior to body contouring surgery is associated with a significant lower complication rate (odds ratio 0.24; CI 0.07–0.79) and the percentage excess weight loss (odds ratio 0.96; 95% CI 0.92–1.00) was an independent predictor for the occurrence of complications. The overall complication rate was 27.9% with a major complication rate of 8.8%. Most frequent procedures were abdominoplasty (61%) and breast reduction/mammoplasty (25%). **Conclusion:** This study emphasizes the importance to strive for a stable weight close to normal before surgery to minimize the risk of complications. The positive effects of the long-term results of bariatric

surgery tolerate the relative high complications rate. Careful pre-operative planning and patient selection are essential to optimize the results of body contouring surgery of post-bariatric patients.

Introduction

With the worldwide increase of obesity, bariatric surgery is expanding proportionally. Surgery is the only treatment resulting in long-term, sustained weight loss and decrease in co-morbidities [1] but also comes along with unsightly excessive and lax skin. Following bariatric procedures an increasing number of patients is seeking body contouring surgery. Although these operations are associated with an increase in quality of life and a high patient satisfaction, the relative high complication rates [2–4], negatively affect these potential gains.

Controversy exists in the literature about the predictors of poor outcome [2, 3, 5]. Pre-body contouring BMI [2–4, 6, 7], percentage excessive weight loss [5], smoking [8–10], diabetes mellitus and/or hypertension [8], nutritional deficiency [11] ASA classification [5], total amount of removed tissue [4, 7], intra-operation time, multiple procedures, maximum BMI and change in BMI from maximum to current BMI [12] are mentioned variable as risk factors.

In this study we analyzed the results of body contouring surgery in weight loss surgery patients to identify predictors of complications in order to optimize patient selection and appropriate timing of surgery. Factors influencing patient satisfaction with the outcome of body contouring surgery were analyzed.

Patients and Methods

Patients

A total of 465 patients underwent weight loss surgery at the St Antonius Hospital in Nieuwegein over a 10-year time period (November 1995 to April 2005). Of these patients 61 underwent body contouring surgery in the same hospital following massive weight loss. Patients were included in the study if adequate documentation was available. Patients were referred to the Department of Plastic and Reconstructive Surgery with a time interval of at least 2 years following the bariatric procedure if they had complaints of redundant skin and weight has stabilized.

Data Collection

A retrospective chart review was performed. The following data and variables were collected: patient's age, sex, BMI at the time of bariatric and body contouring surgery, the percentage of excess weight loss, current BMI, weight of resected tissue, smoking status, co-morbidity and medicine use at the time of body contouring surgery, and the type of bariatric and body contouring procedures. Weight changes in the 3 months immediately prior to the reconstructive surgery were recorded.

Outcome

Complications and interventions associated with each complication were recorded. Complications were categorized into 5 grades according to the modified Clavien classification (table 1) [13, 14]. This is a therapy-oriented grading system and differentiates in five degrees of severity upon the intention to treat. Patient satisfaction was analyzed by asking patients to what extent they were satisfied with the outcome of the reconstructive surgery. The results were expressed on a scale ranging from 1 (very satisfied) to 4 (very dissatisfied).

Statistical Analyses

Statistical analysis was performed using SPSS for Windows version 12.0.1 (SPSS Inc, Chicago, IL, USA). Uni- and multivariate logistic regressions were used to define odds ratios for potential risk factors for complications. Regression analysis was performed to determine factors influencing patient satisfaction. Student's t-test and multivariate analysis were used for parametric variables, nominal variables were analyzed by Pearson's chi-square test. A two-sided p value < 0.05 was considered statistically significant.

Results

Of the 61 patients who underwent body contouring surgery, a total of 43 (70.5%) patients (2 males, 41 female) could be included in the study (table 2). 18 patients were excluded: 7 because of insufficient documentation, 3 patients did not want to participate, and 8 patients were lost to follow-up.

The mean age of the patients was 41.5 years (range 23–60 years). The mean weight before the primary bariatric procedure was 138.2 kg (106–230 kg) with a mean BMI of 48.2 kg/m² (35.8–79.5 kg/m²). 40 patients (93%) underwent laparoscopic gastric banding (LAGB), and 3 patients underwent gastric bypass surgery as a primary procedure. Due to unsatisfactory results or band-related problems, 11 of the 40 LAGB patients underwent gastric bypass surgery as a redo-operation.

The patients experienced a mean excess weight loss of 70.7% at a mean interval of 42.1 months (8–110 months) between their primary bariatric procedure and body contouring surgery, resulting in a mean weight of 86.9 kg (57.0–177.0 kg) and a BMI of 30.7 kg/m² (21.5–65.0 kg/m²) at the time of body contouring surgery.

A total of 68 body contouring procedures were performed in 43 patients; 24 patients (55.8%) underwent 1 operation, 13 (30.2%) underwent 2 operations, and 6 (14%) of the patients underwent 3 operations. Almost all (94.1%) operations were single procedures. Table 3 summarizes the procedures performed. Most patients had an abdominoplasty (61%) or breast reduction/mammarectomy (25%). In 60.3% of the body contouring procedures, patients had a stable weight at least 3 months before surgery.

The overall complication rate was 27.9%. Complication rates according to the modified Clavien classification were grade 0: 72.1%, grade 1: 19.1%, grade 2: 4.4%, grade 3b: 4.4%. There was no post-operative mortality (table 4). The operation most frequently associated with complications was abdominoplasty; 78.9% of all complications and all major

Table 1. Clavien classification of surgical complications

Grade	Definition
1	any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions*
2	requiring pharmacological treatment with drugs other than such allowed for grade 1 complications. (blood transfusions and total parenteral nutrition are also included)
3	requiring surgical, endoscopic or radiological intervention
3a	intervention not under general anesthesia
3b	intervention under general anesthesia
4	life-threatening complication (requiring intensive care management)
4a	single organ dysfunction
4b	multiorgan dysfunction
5	death of a patient

*Allowed therapeutic regimens are drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes and physiotherapy. This grade also includes wound infections opened at bedside.

Table 2. Patient characteristics

Patient characteristics	n	%	Mean (min–max)
Patients	43		
Sex (male/female)	2/41	4.7/95.3	
Age			41.5 (23–60)
Co-morbidity	24	55.8	
Diabetes mellitus	4	9.3	
Hypertension	23	53.5	
Bariatric surgery type			
LAGB	40	93.0	
Gastric bypass (primary/secondary)	3/11	7.0/25.6	
Pre-bariatric surgery			
Weight, kg			138.2(106–230) / SD 23.7
BMI			48.2 (35.8–79.5) / SD 8.5
Pre-body contouring surgery			
Weight, kg			86.9 (57.0–177.0) / SD 20.0
BMI			30.7 (21.5–65.0) / SD 7.2
Interval between bariatric and body contouring surgery, months			42.1 (8–110) / SD 26.5
Weight loss			
Weight, kg			50.1 (15.0–81.1)
BMI			17.5 (5.0–30.8)
Excess weight loss, %			70.7 (29.8–100.3)
Smokers	8	17	

Table 3. Type of body contouring surgery

Body contouring procedure	Total amount performed	% of patients undergoing procedure
Abdominoplasty	38	55.9
Breast augmentation/reduction	15	22.1
Liposuction legs	3	4.4
Dermolipectomy legs	4	5.9
Dermolipectomy arms	1	1.5
Dogear correction	3	4.4
Abdominoplasty + breast reduction	2	2.9
Abdominoplasty + liposuction tights	1	1.5
Dermolipectomy legs + dogear correction	1	1.5
Total	68	100

complications (grade 3b) followed an abdominoplasty. Three patients had a complication which required operative management because of hemorrhage.

Patients with a complicated body contouring procedure had a significantly higher BMI than patients who had an uncomplicated procedure (33.5 vs. 28.7 kg/m²; $p < 0.005$, 95% CI 0.2–9.3 kg/m²). The mean difference was 13.8 kg (95% CI 1.0–26.6 kg).

The patients were subdivided into 4 categories based on BMI: normal weight (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²), obese (30.0–39.9 kg/m²) and morbidly obese (>40 kg/m²) (fig. 1). There was a linear relationship between weight

status and complication rate. Obese (BMI > 30 kg/m²) patients had a significantly increased complication rate when compared to non-obese (BMI < 30 kg/m²) patients (42.3 vs. 19.5%; $p < 0.05$).

Risk Factor Analysis

Univariate analysis was performed to identify risk factors for the occurrence of complications (table 5). The BMI at the time of body contouring surgery (odds ratio 1.14; 95% CI 1.01–1.28) and percentage of excess weight loss (odds ratio 0.96; 95% CI 0.93–0.96) were highly significant parameters as predictors of complications. Furthermore, a stable weight

Table 4. Classification of surgical complications according to the modified Clavien classification

Grade	Type of complication	Amount (%)	Total (%)
1	Seroma	10 (14.7%)	13 (19.1%)
	Minor infection	3 (4.4%)	
2	Deep infection	3 (4.4%)	3 (4.4%)
3	Hematoma	3 (4.4%)	3 (4.4%)

Table 5. Univariate analysis testing the effect of each variable on the occurrence of any complication

Variable	Odds ratio (95% CI)	p value
Age	1.03 (0.98–1.09)	0.247
Gender	2.67 (0.16–44.91)	0.496
Prior weight loss surgery	2.02 (0.64–6.36)	0.232
BMI	1.14 (1.01–1.28)	0.029
% Excess weight loss	0.96 (0.93–0.96)	0.027
(Morbid) obesity (BMI > 30 kg/m ²)	3.03 (1.01–9.05)	0.048
Smoker	0.96 (0.26–3.54)	0.953
Hypertension	0.81 (0.25–2.66)	0.727
Diabetes	0.85 (0.08–8.74)	0.893
Stable weight > 3 months	0.29 (0.09–0.87)	0.028
Weight resected tissue	1.00 (1.00–1.00)	0.111

over a period of at least 3 months prior to body contouring surgery results in significant less complications (odds ratio 0.29; 95% CI 0.09–0.87). The total cohort was subdivided based on BMI into two categories: obese (BMI >30 kg/m²) and non-obese (BMI < 30 kg/m²). A significant increase in complications was seen in obese patients (odds ratio 3.03; 95% CI 1.01–9.05). All other variables failed to predict an increased risk for complications to occur.

Following univariate analysis, multiple logistic regression was performed to identify independent predictors of complications. A stable weight over a period of at least 3 months prior to body contouring surgery (odds ratio 0.24; 95% CI 0.07–0.79) is an independent predictor for a lower complication rate, and the percentage excess weight loss (odds ratio 0.96; 95% CI 0.92–1.00) was a significant predictor of complications.

Patient Satisfaction

67% of the patients were satisfied with the overall result of the operation and 72.1% with the scars in particular. The occurrence of post-operative complications did not influence patient satisfaction (satisfaction score 2.3 vs. 2.5). Only weight increase after body contouring surgery was significantly associated with patient satisfaction: patients with a stable weight after the operation were significantly more satisfied than those with an increase in body weight (satisfaction score 1.9 vs. 2.6; $p < 0.05$). All other factors (number of operations, type of operation, hospital stay) failed to show any influence on patients' satisfaction.

Fig. 1. Percentage of complications per BMI category.

Discussion

This retrospective study of 43 weight loss surgery patients undergoing body contouring surgery demonstrates that a stable weight over a period of at least 3 months prior to body contouring surgery results in a significant lower complication rate. Furthermore, percentage of excess weight loss prior to body contouring surgery has significant impact on the development of complications. A linear relationship was found between weight status and complication rate. The relative high complication rate was of no influence on patient satisfaction; 67% of the patients were satisfied or very satisfied with the results of the reconstructive surgery.

The worldwide increase in bariatric surgery over the past decades results in a growing demand for body contouring surgery [15]. In order to optimize the outcome of body contouring surgery, it is mandatory to identify predictors both in terms of complications and patient satisfaction.

The overall complication rate of 27.9% in the present study is high compared to complication rates in non-obese subjects, but similar to that reported in the literature (20–66%) [2–5]. Our major complication rate (grade 2 and 3b: 8.8%) is relatively low in comparison with that found by Neaman et al. [4] (16%) and Vastine et al. [3] (13%), but a comparison with the literature is difficult because of the variety of definitions of minor and major complications [2–4, 6].

Table 6. An overview of risk factors for body contouring surgery in post-bariatric surgery

Reference	Number of subjects	Type of study	Risk factors
Greco et al. [5]	222	retrospective	ASA classification % weight loss
Au et al. [6]	129	retrospective	BMI
Hensel et al. [15]	199	retrospective	smoking DM/HT
Rogliani et al. [10]	57	retrospective	smoking
De Kerviler et al. [7]	104	retrospective	BMI total resection weight
Arthurs et al. [2]	126	retrospective	BMI
Neaman et al. [4]	206	retrospective	BMI amount of removed tissue
Vastine et al. [3]	90	retrospective	BMI
Agha-Mohammadi et al. [11]	–	review	nutritional deficiency
Gravante et al. [9]	60	prospective	BMI
Coon et al. [12]	449	prospective	intra-operation time multiple procedures maximum BMI change (maximum minus current) in BMI

Many risk factors for body contouring surgery after massive weight loss have been studied in the literature, but only few are addressed as significant of poor outcome (table 6). In our study, BMI was a significant risk factor for post-operative complications after body contouring surgery, which parallels the findings of other authors [2, 6]. Most patients who seek body contouring surgery after weight loss are still overweight, and obesity is a well-known risk factor for complications of surgery in general [16]. Most studies, except for Kroll and Netscher [16], fail to find a linear relationship between BMI and complication rate. However, a cut-off BMI above which the complication rate significantly increases, as found in our study, was also described by others [4, 6, 16]. Patients with a BMI < 30 kg/m² experienced significant less complications than patients with a BMI > 30 kg/m² (19.5 vs. 42.3%; $p < 0.05$). The percentage of excess weight loss prior to body contouring surgery was an independent predictor for post-operative complications. This is interesting as it emphasizes the importance to strive for a weight close to normal before surgery to minimize the risk of complications. No relationship was found between the maximum weight before bariatric surgery or total weight of resected tissue at body contouring surgery and complications which is in contrast to findings of Coon et al. [12] and Neaman [4].

The most interesting secondary finding of our study was the influence of a stable weight prior to surgery. Patients hav-

ing a stable weight plateau for 3 months or longer before body contouring surgery experience significant less complications in comparison to patients with a pre-operative variable weight (19.5 vs. 45.8%). Except for Kerviler et al. [7], no author emphasize the importance of a stable weight. An exact explanation for this relationship cannot be given thus far, but one hypothesis is that the nutrition status is better in patients with a stable weight because the body is no longer in a katabolic state. Bariatric surgery may induce nutritional imbalance through malabsorption and intake restriction [17, 18]. This can result in vitamin deficiencies and protein malnourishment, both negatively influencing wound healing. Weight reduction after bariatric surgery plateaus after 12–18 months, and most patients have significant lax and redundant skin, making body contouring surgery desirable at this time. However, this is also the period during which patients have minimal nutritional reserves, because 50% of the vitamin and mineral deficiencies occur within the first year [11]. No recovery time for the body has passed at the time of body contouring surgery. Due to their strict selection criteria like a minimum excess body mass index loss $\geq 30\%$ and long plateau phase of 12 months, de Kerviler et al. [7] did reduce their complication rate from 40 to 26.9% which support our findings. In a study of Agha-Mohamadi and Hurwitz [11], nutritional supplementation reduced the complication rate from 66 to 18.9%. In which way a stable weight plateau influences the outcome of

body contouring treatment is not yet clear, but these results emphasize that timing of surgery is of great importance.

As most severe nutritional deficiencies develop after bypass surgery, we expect to see more complications in patients after gastric bypass surgery in comparison to gastric banding. However, we failed to find such a relationship. Thus, the impact of the surgical treatment applied to achieve weight loss is still unclear [3, 5, 19]. Further studies are necessary among gastric bypass and gastric banding patients to analyze if the surgical procedure applied to achieve weight loss has any effect on the outcome of body contouring interventions.

The present study is a retrospective analysis with its known shortcomings. Not all indicators noted in the literature were analyzed because of missing data. Co-morbidities such as hypertension, diabetes mellitus and cardiovascular disease are generally associated with a high complication rate [4]. As the number of patients with co-morbidities in our study was rather small (14 out of 68 procedures), no firm conclusion could be drawn from our data.

The complication rate did not influence patients satisfaction following body contouring surgery. Patients suffer from lax and redundant skin after massive weight loss which limits

physical activity and adversely affects the patient's quality of life [20]. Body contouring surgery should therefore be classified as functional surgery, positively contributing to the long-term results of bariatric surgery.

Conclusion

A stable weight prior to body contouring surgery in previously morbidly obese patients results in a significant lower complication rate. Furthermore, patients' BMI and percentage of excess weight loss are highly significant risk factors for complications. The positive effects of body contouring surgery on the long-term results of bariatric surgery counterbalance the relatively high complication rate. Careful pre-operative planning and patient selection are essential to optimize the results of body contouring surgery in post-bariatric patients.

Disclosure Statement

The authors declare no conflicts of interest.

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