Body Contouring Surgery in Post-Bariatric Patients

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Body Contouring Surgery in Post-Bariatric Patients

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voor mijn ouders
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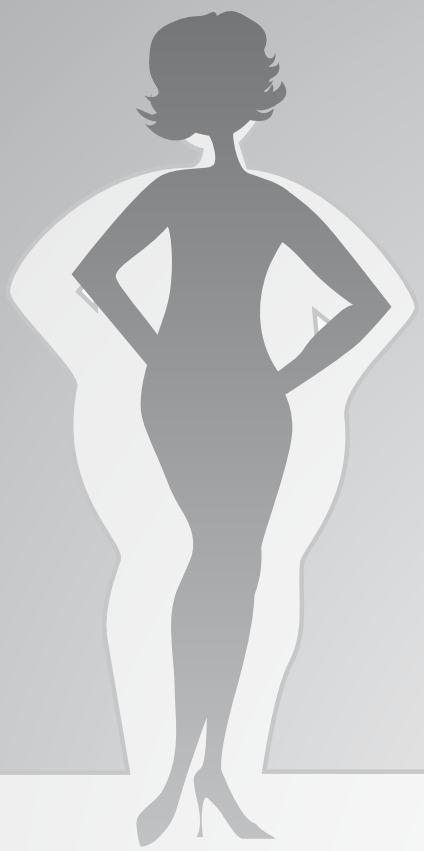
CONTENTS



Chapter 1

General introduction and outline of this thesis

Obesity and bariatric surgery

Morbid obesity is a life-threatening condition with severe co-morbidity and associated with a reduced quality of life. Obesity has been acknowledged as a chronic disease by the World Health Organization and it is reaching pandemic proportions across the world.[1-2] In 2008, almost 50% of the Dutch population (>20years) was overweight and 16% was obese.[3] The estimated prevalence of morbid obesity is 1.0-1.5%. Obesity is classified by means of the body mass index (BMI: weight/(height^2)). A BMI of 20-25kg/m^2 is defined as normal weight, a BMI of 25-30 kg/m^2 as overweight, a BMI of 30-40 kg/m^2 as obesity and a BMI of >40 kg/m^2 is defined as morbid obesity. The main obesity related co-morbidities are diabetes mellitus, cardiovascular disease, hypertension, dyslipidemia, obstructive sleep apnea syndrome and gastro-esophageal reflux.

Bariatric surgery is the most effective and durable treatment for long-term and sustained weight loss.[4] Weight loss is accompanied by resolution of obesity linked co-morbidities and an improvement in quality of life.[4-5] Indications for bariatric surgery are a BMI>40 kg/m^2 or a BMI>35 kg/m^2 with significant co-morbidities (diabetes mellitus, hypertension, obstructive sleep apnea syndrome).[6] A variety of surgical weight loss methods are developed and they can be categorized into three groups: restrictive (e.g. laparoscopic adjustable banding [LAGB] and gastric sleeve), malabsorptive (e.g. jejunal ileal bypass) and combination procedures (e.g. Roux-en-Y gastric bypass [RYGB], duodenal switch). Presently, in the Netherlands sleeve gastrectomy and RYGB are the most performed bariatric surgical procedures. The mean percentage of excess weight loss (EWL%) is greater after RYGB compared to sleeve gastrectomy. The definition of successful bariatric surgery is still under debate and many different definitions are used, like an EWL% of >50% or a post-operative BMI<30. Another evaluation system is the BAROS analysis, which evaluates the three main goals of bariatric surgery: weight loss, improvement of medical conditions and quality of life.[7]

Body contouring surgery

The excess of loose hanging skin, also described as a deflated body, often hampers the long-term health benefits after bariatric surgery. The severity of the remaining contour deformities varies per individual and depends on many factors such as age, gender, genetic predisposition, preoperative appearance and degree of weight loss. The excess of skin can result in hygienic problems, skin rashes, functional impairment and social and psychological problems. The goal of post-bariatric body contouring is to remove the excess skin and reshape the body to patients' actual weight. The drawbacks of improved contour include the risk of complications, remaining scars and extra health care costs.

Various techniques have been described for body contouring after massive weight loss. The appropriate type of procedure is determined by anatomical indicators, like skin quality, the location and the amount of excess skin, as well as patient characteristics like

co-morbidity, smoking habit and functional complaints. The preference and experience of the plastic surgeon will also influence the decision for the type of surgery. Body contouring of the abdomen is most frequently performed[8] and can be done – in increasing extensiveness - by panniculectomy, conventional abdominoplasty, Fleur-de-lis abdominoplasty, circumferential abdominoplasty and lower body lift. The breasts are the second most reported area of concern. Reshaping the breast can be achieved by reduction in case of hypertrophy (figure 1), mastopexy in case of ptosis with adequate volume and augmentation (autologous or implant) in case of breast ptosis without adequate volume.

The total lower and upper body can be reshaped by a lower body lift and upper body lift, respectively. The lower body lift is a combined procedure including correction of abdomen, mons pubis, lower back and buttocks (figure 2). The upper body lift comprises a mammaplasty, correction of the flank and brachioplasty. Less performed single operations are medial thigh plasty (figure 3), brachioplasty (figure 4), buttock contouring and mons pubis lift. In men with pseudo gynaecomasty, surgical correction can also be performed. Multiple simple procedures can be combined in one operation, but this may result in a higher complication rate.[9]

The role of liposuction in massive weight loss patients is controversial. The lax, overstretched skin seems to be less suitable for liposuction, which technique and results are based on the elasticity and retraction of the skin. The combination of liposuction and dermolipectomy has been proven however to be safe in post-bariatric patients resulting in increased patient satisfaction in some studies.[10-11]

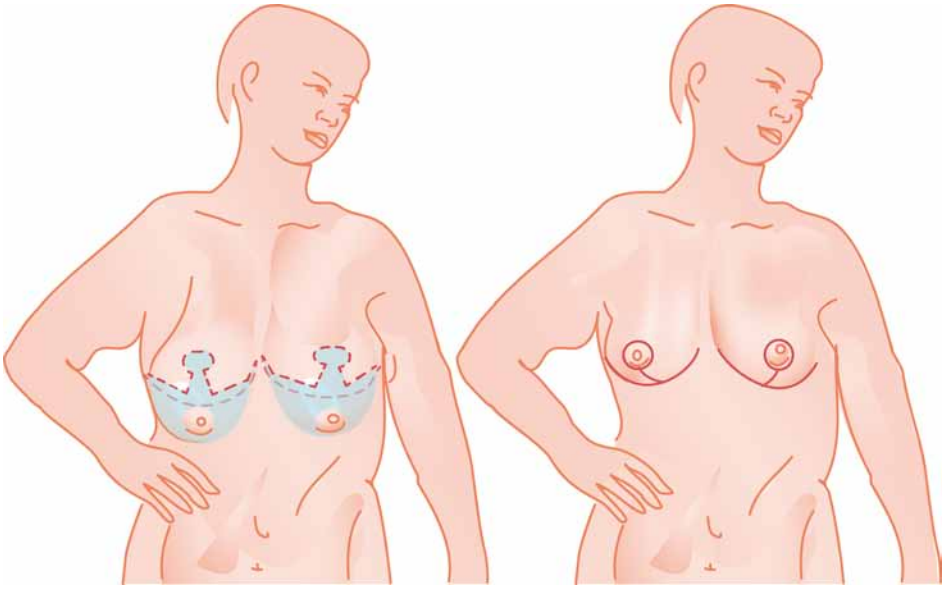


FIGURE 1
Breast reduction

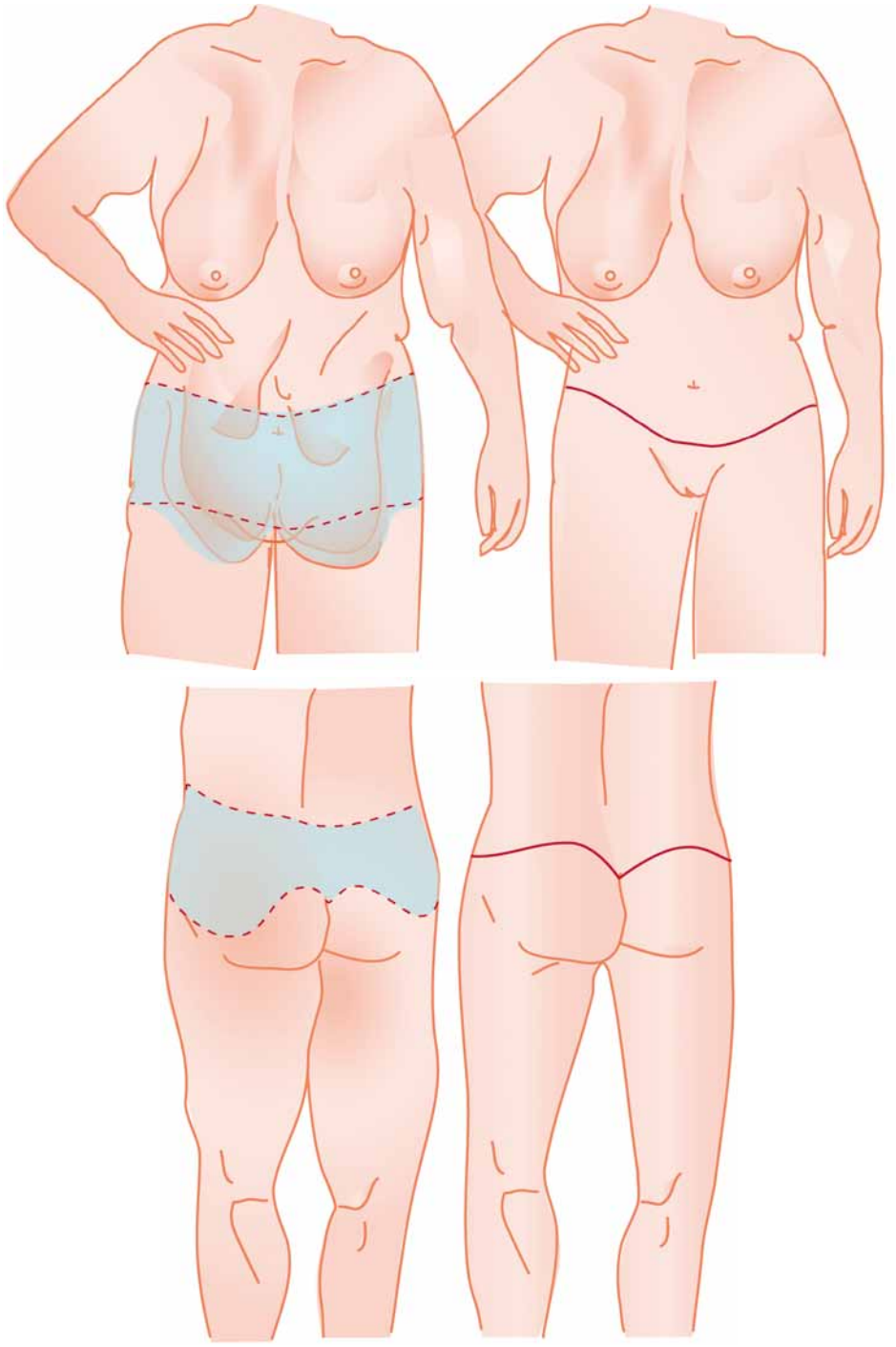


FIGURE 2
Lower body lift

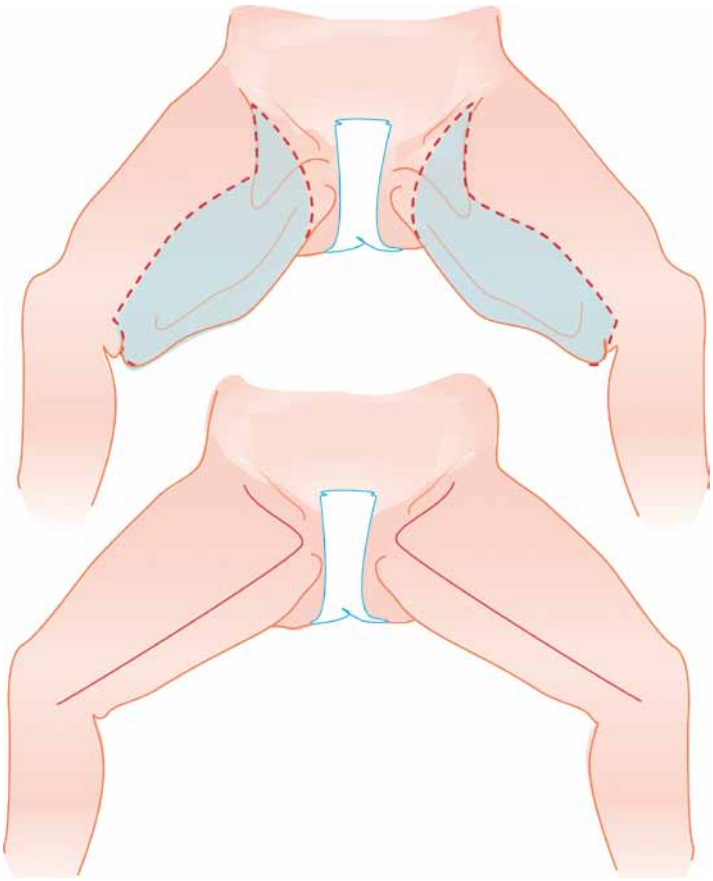


FIGURE 3
Medial thigh plasty

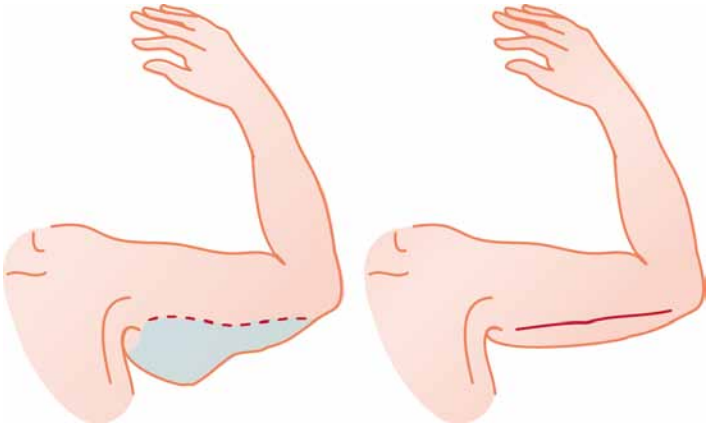


FIGURE 4
Brachioplasty

Risk factors for complications

Body contouring surgery is associated with a significant rate of complications (20-66%)[12-14], which may negatively affect the potential benefits. Controversy exists in the literature about risk factors for complications. Pre-body contouring BMI[12-14], percentage excess weight loss[15], ASA classification[15], co-morbidity like diabetes mellitus and/or hypertension[16], nutritional deficiencies[17], smoking[18], total amount of removed tissue[14], operating time, multiple and combined procedures, maximum BMI and change in BMI from maximum to current BMI[9] are reported risk factors. Wound-related complications are frequently described after body contouring surgery and include wound dehiscence, infection, seroma and necrosis.[9] Other possible complications include hematoma, deep venous thrombosis and pulmonary embolism.

Nutritional deficiencies are a well-known side effect of bariatric surgery and are more explicit after combined or malabsorptive procedures compared to restrictive procedures.[19] These deficiencies can occur at any time after bariatric surgery.[20-21] A variety of macro- and micronutrient deficiencies are described and deficiencies of iron, protein, vitamin B12, vitamin C and vitamin D, ferritin and anemia are frequently seen. Many deficiencies will remain asymptomatic, but in stress situations like subsequent body contouring surgery these deficiencies can become symptomatic due to an increased demand. In recent years, the role of nutritional deficiencies in wound-related complications in massive weight loss patients is getting more attention in the literature. Poor nutritional status negatively affects wound healing in other surgical procedures and optimization of nutritional state in oncological, geriatric and burn patients is an essential part of treatment.[22-23] The negative impact of nutritional deficiencies in post-bariatric body contouring is expected to be similar, but studies in this specific patient population are presently lacking in the literature.

Results of body contouring surgery

Bariatric surgery without body contouring has a beneficial influence on psychological functioning and quality of life.[4-24] However, stabilization or even a decline of this effect is seen starting 18-24 months after surgery. This may be in part attributable to the psychological, social and physical problems due to loose, hanging skin. Improvement in quality of life is described after body contouring surgery[25], but conflicting results are found in the literature and most results are limited to the first post-operative years.[26-27] If post-bariatric body contouring has a positive effect on patients' quality of life, it may play a beneficial role in the long-term improvement in quality of life, which is one of the outcome measures of bariatric surgery. However some patients are dissatisfied with the post-operative result.[8] An explanation for this dissatisfaction can be that patients' expectations about the post-operative result were not met after surgery. Patients may pursue body contouring surgery for its anticipated positive effects on psychological and social

aspects, for an increase of physical activity or for aesthetic improvement.[28] Preoperative insight in patients' motives and expectations may provide the health care professional the opportunity to match these subjective concerns about body contouring surgery to realistic expectations. This will result in better informed patients which might benefit patient satisfaction.

Indication and reimbursement

The increasing demand for post-bariatric body contouring surgery is accompanied by a debate among professionals, patients and health care insurance companies about the selection of patients for body contouring surgery, both abroad and in the Netherlands. There are two distinct aspects, i.e. the medical (indication) and the financial (reimbursement). The debate centers on the question whether body contouring surgery after massive weight loss should be seen as part of the treatment of morbid obesity or as pure aesthetic surgery. From a pure medical point of view any complaint or impairment due to excess skin after massive weight loss can be an indication for treatment including surgical correction. The problems arise with the reimbursement of post-bariatric treatment by insurance companies. In the Netherlands, reimbursement is based on BMI and the Pittsburgh Rating Scale (PRS). The PRS classifies the degree of skin surplus in different body areas and is the only validated classification system of skin deformities after massive weight loss nowadays.[29] However, the PRS is a purely descriptive classification and as such it has several drawbacks. The PRS does for example not include important items like the amount of weight loss, the degree of physical impairment, the degree of psychological distress of the patients nor risk factors for surgery. Therefore the PRS may not be an ideal instrument for decisions about reimbursement of post- bariatric surgery. It should be noted that Dutch health care regulation prohibits the reimbursement of any surgery – except post oncologic breast reconstruction – purely for reasons of psychological distress.

Aim and outline of this thesis

The growth of post-bariatric body contouring in the field of plastic surgery makes a national clinical guideline for patient selection and treatment mandatory. In developing such a guideline, we should get more insight in risk factors for complications, post-bariatric patient's concerns and expectations of the post-operative result and the expected result of body contouring surgery on short and long-term quality of life. The underlying purpose of this thesis is improvement of care for post-bariatric patients presenting for body contouring surgery.

The first part of this thesis focuses on patient selection. In chapter 2 we analyzed the nutritional deficiencies after gastric bypass surgery. This chapter answers the question at what time most deficiencies occur after the operation and what the value is of pre-

operative laboratory control. Chapter 3 presents a validation study of the Pittsburgh Rating Scale (PRS). The applicability of this classification system for clinical use in the Netherlands is discussed. The motives, barriers and expectations of massive weight loss patients concerning body contouring surgery are outlined in chapter 4 and this chapter contains a preoperative checklist, which can be used in the screening of candidates for body contouring surgery. The second part addresses the question if the quality of life improves on the short (chapter 5) and long-term (chapter 6) after body contouring surgery. In the third part we focus on post-operative complications. In chapter 7 we analyzed the results of body contouring surgery in patients after laparoscopic gastric banding and in chapter 8 we studied the complications in post-gastric bypass patients. The last part of this thesis contains a general discussion in which we will provide the overall implications of this thesis and recommendations for the care of the post-bariatric patient (chapter 9). This thesis is completed with a summary of the results (chapter 10).

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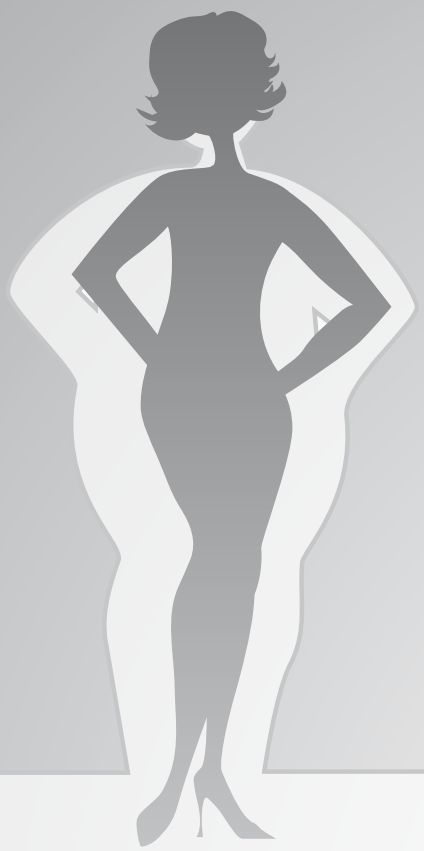
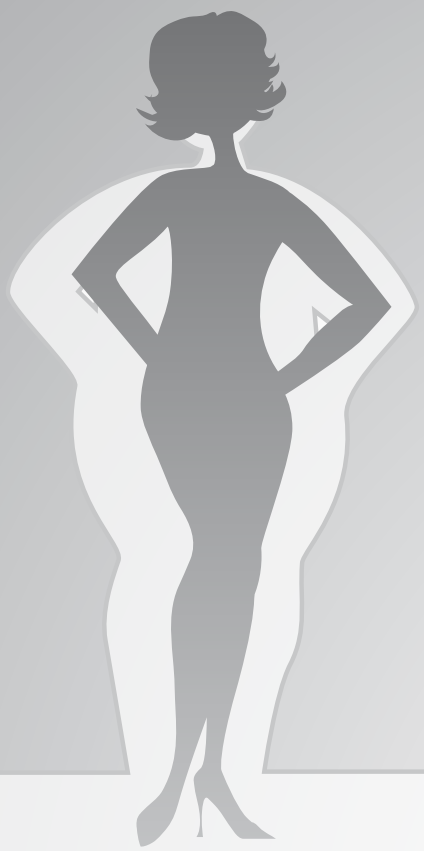


Part I

Patient selection



Chapter 2

Nutritional Deficiencies in Gastric-Bypass Patients

Incidence, Time of Occurrence and Implications for Post-operative Surveillance

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ABSTRACT

Background

Post-operative nutritional deficiencies are a common complication following bariatric surgery. The incidence and time of occurrence are not clear, and the efficacy of supplementation remains questionable. Clear guidelines for nutritional follow-up and counselling are needed.

Methods

Preoperative and post-operative deficiencies were determined in a group of 427 gastric bypass patients. The predictive value of preoperative laboratory findings for the development of post-operative deficiencies, the time of occurrence and the effect of supplementation of common deficiencies was studied.

Results

Most common preoperative deficiencies were of folic acid (21.3%), vitamin D3 (17.5%) and iron (21.8%). Post-operative, a significant increase in the number of patients with anaemia and deficiencies of ferritin and vitamin B12 was found. Most deficiencies occur between 12 and 15 months post-operatively, but vitamin D3 deficiency occurs significantly earlier at 9.7 months. A preoperative iron, folic acid or ferritin deficiency results in a significant higher risk for developing a post-operative deficiency despite supplementation, and ferritin deficiency occurs significantly earlier in these patients. Oral treatment of post-operative vitamin B12 and vitamin D3 deficiencies was successful in more than 80% of the patients in contrast to oral treatment of anaemia which was only successful in 62.5% of the patients.

Conclusion

Our study emphasizes the importance of preoperative assessment and treatment of nutritional deficiencies in morbidly obese patients undergoing gastric bypass surgery. Despite limited efficacy, post-operative oral supplementation should be encouraged as it decreases the incidence of deficiencies.

INTRODUCTION

The increasing demand of bariatric surgery requires ongoing improvement of the preoperative and post-operative care of morbidly obese patients. Outcome reporting in bariatric surgery mainly focuses on weight loss, improvement of co-morbidities and quality of life. Post-operative nutritional deficiencies are a complication of bariatric surgery, in particular after malabsorptive procedures. Deficiencies of protein, iron and vitamins A, B12, C and D are frequently reported and may occur despite supplementation.[1-7] Many deficiencies will remain subclinical but could become clinical in stress situations like surgery. Morbid obesity itself is associated with nutritional deficiencies as well.[8-9]

The occurrence of nutritional deficiencies has been subject of an increasing number of reports, but little is known about the incidence and time of occurrence of deficiencies in the post-operative follow-up and the efficacy of post-operative supplementation. Guidelines regarding optimal nutritional counselling and laboratory follow-up are lacking in the literature to date.

The goal of the current study is to determine the incidence and time of onset of nutritional deficiencies in post-gastric bypass patients receiving standard supplementation. The predictive value of preoperative laboratory findings for post-operative deficiencies and the effect of supplementation of common deficiencies (ferritin, vitamin B12 and vitamin D3) was studied.

METHODS

Patient Selection and Data Collection

All patients who underwent gastric bypass surgery at the St Antonius Hospital in Nieuwegein in the period January 2010 until January 2012 were included in the study, provided that laboratory results regarding nutritional status before and/or after gastric bypass were available. Electronic patient records were reviewed retrospectively. The following data and variables were collected: age, gender, BMI pre- and post-gastric bypass, nutritional status pre- and post-gastric bypass and treatment of deficiencies.

Preoperative Consultation and Operative Procedure

Patients were selected for gastric bypass surgery after careful selection by a multidisciplinary team (surgeon, dietician, psychologist and endocrinologist). Indications for surgery were in accordance with the criteria of the 'National Institutes of Health consensus development conference statement for surgical treatment of morbid obesity'.[10] A standard laparoscopic gastric bypass procedure was performed in all patients with creation of a small (20–30 ml) gastric pouch anastomosed by linear stapling with a 100–120-cm

antecolic Roux-loop. The nutritional status prior to surgery was not routinely confirmed by laboratory testing. No specific dietary protocol was used preoperatively.

Post-operative Follow-up

One week post-operatively, all patients were started on supplementation with 'Calci Chew D3' (calcium carbonate/colecalciferol 1000 mg/800IU) once daily and multivitamin preparation with 100% iron two times daily. Follow-up was conducted by a specialized nurse practitioner and was scheduled at 2 and 6 weeks and 3, 6, 9 and 12 months post-operatively in the first year and every 3 to 6 months in the second post-operative year. At each consultation, BMI was calculated and patients were screened for signs and symptoms of deficiencies and use of supplement intake. Blood samples to evaluate nutritional status were obtained once or at various intervals within the first year after surgery and at least once a year after the first year. When deficiencies were suspected despite supplementation, extra laboratory control took place.

Patients were considered deficient for specific nutrients when laboratory values were below the lower value of the reference range used by the laboratory. Common deficiencies were treated according to a standard treatment protocol. Anaemia with low iron (<10 µmol/l) and/or low ferritin (<10 µg/l) was treated with ferrous fumarate 200 mg 3dd1, and vitamin B12 deficiency with levels between 111 and 150 pmol/l was treated with oral supplementation of vitamin B12 (1000 µg a day). Patients with other deficiencies were referred to the endocrinologist for further analysis and treatment. In the case of severe deficiencies, pernicious anaemia or failed response to oral supplementation, intramuscular or intravenous treatment was started.

Outcome Measures

Preoperative laboratory tests were collected at different intervals before surgery; tests up to 1 year prior to surgery were considered to represent the preoperative nutritional state and were included for analysis. Post-operative laboratory tests were taken at different intervals during follow-up which were all used for analysis. Data of the following nutrients were available: haemoglobin, iron, transferrin, ferritin, vitamin D3, vitamin B1, vitamin B6, vitamin B12, calcium, phosphate and folic acid. Only nutrients with a post-operative deficiency in more than 5% of the patients were used for analysis in the current study.

Treatment efficacy was evaluated in all patients treated for a post-operative anaemia, vitamin B12 or vitamin D3 deficiency if a laboratory assessment after treatment was available. Successful treatment was defined as normalization of the laboratory values for a given nutrient. The post-operative plasma concentration of folic acid was used as a marker for supplementation adherence. Post-operative low folic acid levels are rare in post-bariatric patients when routine multivitamins are taken, and therefore, low folic acid levels can indicate lack of adherence to multivitamin supplementation.[11-12] To

determine which deficiencies occur despite standard supplementation, patients with a normal folic acid were compared to patients with a deficiency of folic acid in the period 6–12 months after surgery.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences, version 20.0 (SPSS, Chicago, IL). Patient characteristics and nutritional deficiencies are reported as mean±SD and percentages of the total number of included patients in the study unless otherwise indicated. Overall incidence of nutritional deficiencies and incidence in the first and second post-operative year were determined per patient until onset of deficiency or until time to follow-up when deficiency did not occur. Incidence of the first and second post-operative year was determined in patients who had one or more laboratory tests in, respectively, the first or the second post-operative year. Chi-square tests were used for the comparison of dichotomous variables. For the comparison of parametric and non-parametric variables, Student's t and Mann–Whitney U tests were used, respectively. P value of less than 0.05 was considered significant.

RESULTS

Study Population

During the study period, 447 patients underwent a gastric bypass procedure. Twenty patients were excluded from the study; one patient died of a complication after gastric bypass, one patient was diagnosed with cholangiocarcinoma and decided not to continue follow-up, two patients were controlled in another hospital and in 16 patients, no (post-operative) blood samples were collected. In total, 427 patients were included in this study (see Table 1).

TABLE 1
Patient characteristics, n = 427

Sex	
-male	23.9%
-female	76.1%
Age (years)	47.3 (SD 10.1)
BMI (kg/m2)	
-preoperative	45.3 (SD 5.6)
-post-operative	31.7 (SD 5.7)
EWL (%)	59.3 (SD 19.4)
Follow-up (months)	18.7 (SD 7.4)

TABLE 2
Prevalence and incidence of nutritional deficiencies in all patients pre- and post-operative to gastric bypass surgery

	Preoperative Prevalence, % (95% CI) N = 270	***Post-operative Incidence, % (95% CI) N = 427***	***Months after surgery, mean (95% CI)***
Haemoglobin (<7.0 mmol/l)	2.9 (0.9-4.9)	9.9 (7.0 - 12.7)***	14.8 (12.7-17.0)
Iron (<10 umol/l)	21.9 (16.7-27.1)	25.4 (21.2 - 29.5)*	11.7 (10.4-13.0)
Ferritin (<10 ug/l)	3.2 (1.0-5.4)	14.1 (10.8 - 17.4)***	14.5 (12.8-16.3)
Vitamin B12 (< 140 pmol/l)	3.1 (1.0-5.2)	14.1 (10.8 - 17.4)***	14.1 (12.4-15.8)
Vitamin D3 (< 30 nmol/l)	16.3 (10.5-22.2)	8.0 (5.4 - 10.5)***	9.7 (7.9-11.6)**
Folic acid (< 10 nmol/l)	20.5 (15.5-25.4)	6.8 (4.4 - 9.2)***	12.4 (9.8-15.0)

**Significant (p<0.05) difference in incidence of post-operative deficiency*
***Significant (p<0.05) difference in time of occurrence of post-operative deficiency*
****Significant (p<0.05) difference in incidence of post-operative deficiency compared to prevalence of preoperative deficiency*

In 270 patients, preoperative blood samples were collected with a mean of 7.0 months (SD 3.8) prior to gastric bypass. In 115 patients (42.6%), one or more nutritional deficiencies were diagnosed (see Table 2).

Nutritional Status After Gastric Bypass

After gastric bypass, laboratory tests of 427 patients were available with a mean of 2.3 blood samples (range 1–7) per patient. The first blood sample was collected after a mean period of 9.7 months (range 0–23). At the first post-operative laboratory control, 35.8% of the patients had one or more deficiencies. No significant differences in percentages of post-operative deficiencies were seen between patients who had the first laboratory control before 6 months (43.5% of 85 patients had deficiencies), between 6 and 12 months (33.0% of 282 patients) and after 12 months (38.3% of 60 patients). The most common post-operative deficiency was of iron (25.4%), which occurred significantly more frequent than all other deficiencies. A deficiency of vitamin D3 occurred significantly earlier post-operative compared to deficiencies of other nutrients (9.7 months after surgery). Post-operative, we found a significant increase in the number of patients with anaemia and deficiencies of ferritin and vitamin B12 compared to preoperative, and significantly less patients had a folic acid or vitamin D3 deficiency after the operation (see Table 2).

In the second post-operative year, a ferritin deficiency and a low haemoglobin occurred significantly more frequent compared to the first post-operative year (12.7 vs 7.6% for ferritin deficiency and 9.0 vs 5.2% for low haemoglobin) (see Fig. 1). The incidence of folic acid, iron or vitamin D3 significantly decreased in the second post-operative year compared to the first (respectively 3.1 vs 6.1%, 14.6 vs 20.2% and 3.7 vs 6.8%).

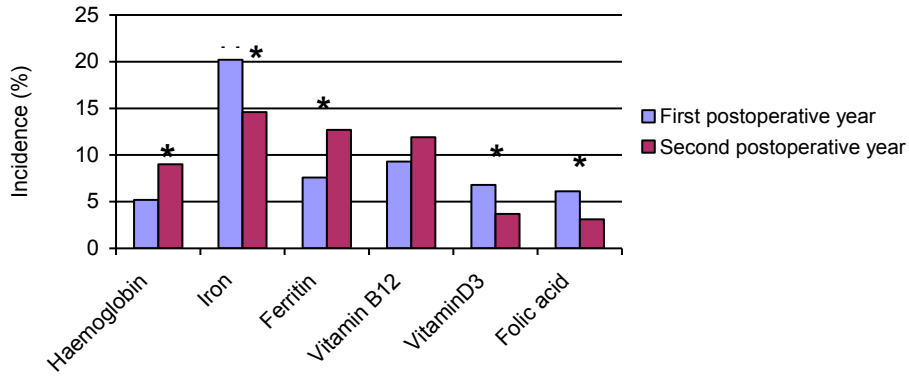

FIGURE 1
The incidence of post-operative deficiencies in the first and second post-operative year.
**Significance (<0.05) difference between first and second post-operative year.*

A preoperative iron, ferritin or folic acid deficiency results in a significant higher risk for developing a post-operative deficiency compared to patients without a preoperative deficiency (see Table 3). A preoperative deficiency of ferritin also results in a significant earlier post-operative ferritin deficiency at 11 months after surgery.

TABLE 3
Incidence of post-operative deficiencies in patients with and without a preoperative deficiency of individual nutrients (n=270)

	Incidence of post-operative deficiency in patients with preoperative deficiency	***Months after surgery mean (CI)***	***Incidence of post-operative deficiency in patients without preoperative deficiency***	***Months after surgery mean (CI)***
Haemoglobin (<7.0 mmol/l)	**25.0%**	**^**	**9.3%**	**13.4 (10.9-15.9)**
Iron (<10 umol/l)	**51.0%***	**9.4 (7.0-11.9)**	**20.5%**	**11.1 (8.6-13.5)**
Ferritin (<10 ug/l)	**71.4%***	**11.0 (7.4-14.6)****	**12.1%**	**15.0 (12.3-17.7)**
Vitamin B12 (< 140 pmol/l)	**14.3%**	**^**	**12.8%**	**13.7 (11.3-16.1)**
Vitamin D3 (< 30 nmol/l)	**4.0%**	**^**	**5.1%**	**9.3 (3.6-15.0)**
Folic acid (< 10 nmol/l)	**15.7%***	**11.9 (5.0-18.8)**	**3.2%**	**8.8 (6.6-11.1)**

Differences between groups were analyzed by Chi square test and Mann-Whitney U test.
** significant (p<0.05) difference in incidence between groups*
*** significant (p<0.05) difference in time of occurrence*
^ insufficient amount of patients for analysis

Adherence to Supplementation

In the period of 6–12 months after surgery, laboratory evaluation was performed in 329 patients. Eighteen patients (5.5%) had a folic acid deficiency and were considered to be noncompliant to standard multivitamin supplementation. In this group, significantly more patients had a ferritin deficiency (22.4 vs 6.6%) and anaemia (22.2 vs 3.3%) than in the group with a normal level of folic acid.

Efficacy of Treatment

The efficacy of treatment of frequently diagnosed post-operative deficiencies was evaluated (see Fig. 2).

A total of 44 patients were treated for a post-operative anaemia (with low iron (<10 µmol/l) and/or low ferritin (<10 µg/l)). Oral treatment with ferrous fumarate 200 mg 3dd1 was started in 40 patients and was successful in 25 patients (62.5%). Venofer (ferrioxidesaccharaat) was started as primary treatment in four patients and secondarily in eight patients because of persisted deficiency. This was successful in all cases.

In 22 patients with a post-operative low vitamin D3 (<30 nmol/l), therapy was started. Seventeen patients indicated that they were not compliant with standard treatment protocol of calcium carbonate/colecalciferol (1000 mg/800EI). After starting the supplementation, 13 patients were no longer deficient. Despite adequate standard supplementation, seven patients remain deficient and extra oral supplementation was started. This was successful in five patients. Oral treatment was successful in 18 patients (81.8%).

A total of 49 patients were treated for low vitamin B12 post-operatively. Oral treatment with vitamin B12 (1000 µg a day) was started in 35 patients and was successful in 30 patients (85.7%). Intramuscular vitamin B12 was started as a primary treatment in 14 patients which was successful in 92.9% (n=13) and as a secondary treatment in 1 patient. This was also successful.

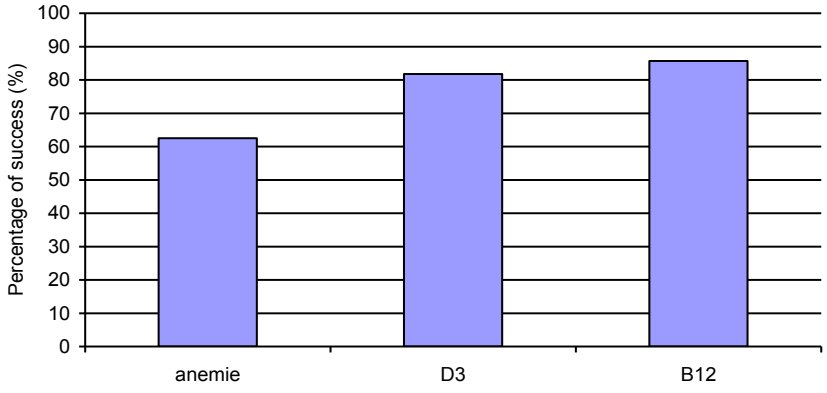

FIGURE 2
Percentage of post-gastric bypass patients successfully treated with oral supplementation.

DISCUSSION

Morbid obesity is a risk factor for nutritional deficiencies.[8-9] Adequate assessment of nutritional status is essential for all bariatric surgery candidates. Deficiencies can develop rapidly but even at long-term after surgery. To date, no guidelines regarding optimal nutritional counselling exist, and the incidence and time of occurrence of individual deficiencies are not clear.

Our study showed a high incidence of preoperative deficiencies of iron, folic acid and vitamin D3, of which the first one tends to persist in the post-operative period. These results are in accordance with the literature.[6,9,13,14] The most important reason for preoperative assessment of the nutritional status is the opportunity to correct deficiencies prior to surgery. After gastric bypass surgery, the bioavailability of certain nutrients is low, and a limited efficacy of oral treatment is described.[15-16] Although in the majority of patients, post-operative oral supplementation of vitamin D and vitamin B12 was effective, still 18% of the patients remain deficient in vitamin D and 14% of the patients in vitamin B12, in which intra-muscular treatment was needed. Oral treatment of anaemia proved to be even more difficult. The high percentage of preoperative iron deficiencies in combination with the high incidence of post-operative anaemia and the limited efficacy of oral supplementation strongly emphasize the importance of preoperative optimization of nutritional status and especially iron deficiency.

A second reason for preoperative assessment is that the preoperative nutritional status is indicative for the risk and time of onset of post-operative deficiencies. Patients with low preoperative ferritin, folic acid and iron were found to have a significant higher risk to be deficient in the same nutrient following gastric bypass. Besides this, patients with a preoperative ferritin deficiency develop this post-operative ferritin deficiency significantly earlier. When optimization of nutritional status is not included in the standard preoperative workup, one should be aware of this phenomenon.

The prevalence and type of post-operative nutritional deficiencies vary greatly among studies due to differences in definitions and post-operative treatment protocols and supplements. We found a significant post-operative increase in the number of patients with anaemia and deficiencies of ferritin and vitamin B12 compared to preoperative which is in accordance with the literature.[2,14,17] The daily recommended intake of essential nutrients is often not reached in gastric bypass patients due to the result of a deficient diet and decreased calorie intake.[18-19] Low bioavailability as a result of a post-operative decrease of hydrochloric acid and intrinsic factor, low intake of meat and the bypassed proximal part of the small bowel also account for the high incidence of post-operative deficiencies. Post-operative deficiencies can occur any time, and most studies report the

prevalence of deficiencies at fixed intervals. Little is known about the peak incidence of common deficiencies. During follow-up, early diagnosis of new developing deficiencies is most important as treatment may prevent severe and symptomatic sequelae. The current study points out that most deficiencies occur between 12 and 15 months post-operative with the exception of vitamin D3. Some variety was seen for different nutrients according to the preoperative status, although this was only proved significant for ferritin. Deficiencies of iron, vitamin D3 and folic acid were significantly more frequently diagnosed in the first compared to the second post-operative year. These early post-operative deficiencies correspond to the most prevalent preoperative deficiencies which suggests that these preoperative deficiencies persist after the operation.

Post-operative standard supplementation and multivitamin use should be encouraged in all patients because the incidence of post-operative anaemia and ferritin deficiency significantly decreases in compliant patients as shown. In the treatment of post-operative deficiencies, it is questionable if an increase in the dosage of the standard daily supplement intake will be effective. The preliminary data of a study by Aarts et al.[20] show a substantial decline in post-operative ferritin and vitamin B12 deficiency in patients taking a supplement containing a high dose of vitamin B12 and iron (14,000% and 500% of the daily recommended dietary allowance, respectively). An increase in the daily intake of vitamin D did not result in less deficiencies.[20] These results suggest an insufficiency of present-day standard supplementation, but further study on the effectiveness and risks of high dose supplementation is warranted.

Our study is the first focussing on time of onset of post-operative deficiencies and emphasizes the predictable value of preoperative nutritional evaluation. As yet, no studies have reported nutritional deficiencies in a similar large cohort of gastric bypass patients. Our study has some limitations as the mean follow-up in our patients was only 1.5 years, and preoperative laboratory screening was not performed in all patients. Despite this, in 270 patients, preoperative and post-operative blood samples were available, a cohort considered large enough to draw conclusions.

Strict and lifelong post-operative follow-up of nutritional status to detect and treat deficiencies is recommended by many authors.[2,4,6,7] No clear guidelines for optimal timing of laboratory control exist and substantiation for the frequency and timing of laboratory testing is lacking. In the ideal situation, clinical and laboratory follow-up should be adapted to the individual patients' risk for development of deficiencies. The first step in the prevention of post-operative deficiencies is preoperative assessment and treatment of deficiencies in all patients. For the timely treatment of existing deficiencies, we advise standard laboratory screening 12 weeks prior to surgery. According to the findings of our study, a preliminary advice could be drawn for post-operative follow-up. Standard

post-operative laboratory control should take place at 9–12 and 15 months following surgery, corresponding to the peak incidence of most deficiencies. When existent deficiencies are not treated before surgery, post-operative follow-up might be performed earlier. Advice for follow-up on the long-term could not be based on the current study due to limited follow-up, but annual follow-up might be justifiable. In the case of persistent vomiting, dumping syndrome, suspicion of low adherence to supplementation or clinical symptoms suggesting nutritional deficiencies and laboratory control may be initiated at an earlier date according to the individual patient.

CONCLUSIONS

Nutritional deficiencies commonly occur in morbidly obese patients undergoing gastric bypass surgery. The first step in prevention of post-operative deficiencies is preoperative assessment and treatment of nutritional deficiencies in all patients. The preoperative nutritional status is indicative for the incidence and time of onset of post-operative deficiencies, which can contribute to optimal nutritional follow-up. Standard supplementation decreases the incidence of post-operative deficiencies.

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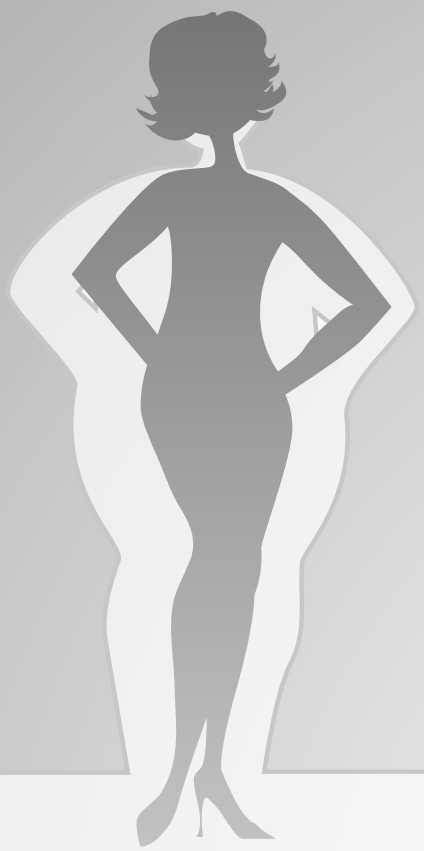

Chapter 3

Classification of Contour Deformities after massive weight loss; The applicability of The Pittsburgh Rating Scale in The Netherlands

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ABSTRACT

Background

The Pittsburgh Rating Scale is the only validated classification system of skin deformities occurring after massive weight loss. The purpose of this study was to replicate the validation of the Pittsburgh Rating Scale classification and to evaluate its usefulness in the treatment of massive weight-loss patients in the Netherlands.

Methods

Thirteen trained observers applied the Pittsburgh Rating Scale to photographs of 25 patients. These photographs showed the 10 regions of the body for which the Pittsburgh Rating Scale is designed. Six of the observers were medical specialists, three were medical interns in plastic surgery and four observers were specialised nurse practitioners. As a measure of inter-rater agreement we calculated the intra-class correlation with a threshold value of 0.6 for good validity. The observers also answered 11 questions about the scale's usefulness in daily practice.

Results

In two consecutive tests the photographs of 10 regions were scored, which resulted in a total of 20 observations per patient. Sixty percent of the intra-class correlation values were below the threshold of 0.6 for good validity. The mean intra-class correlation value was 0.577.

Conclusions

The Pittsburgh Rating Scale could not be validated as a reliable classification system for skin deformities after massive weight loss. The scale however seems to be a good first step in a challenging task. There was no doubt among the observers that a good classification system would be beneficial for adequate treatment. A modified Pittsburgh Rating Scale should include, besides anatomical parameters, functional disability and hygienic impairment scores and peri-operative risk factors.

INTRODUCTION

Morbid obesity is a life-threatening condition with severe co-morbidity and reduced quality of life. Bariatric surgery is increasingly applied as a solution for this problem resulting in massive weight loss, a decrease in co-morbidity and improvement in quality of life.[1] The long-term benefits of bariatric surgery are often hampered by the excess of lax overstretched skin, which in many patients remain after significant and rapid weight loss. It causes deformation of the body with physical discomfort and hygienic problems, all of which negatively influence quality of life.[2,3] The severity of the remaining contour deformities varies per individual and is unpredictable. This variation depends on many factors such as age, gender, preoperative appearance and degree of weight loss.

The increasing demand for plastic surgery to correct these contour deformities makes it necessary to improve the understanding of these problems and to determine the most appropriate treatments. The surgical treatment options range from suction-assisted lipectomy to a total lower body lift depending on the extensiveness of the skin surplus.[4] A valid classification system for these contour deformities is an essential step in the development of a guideline for the treatment of massive weight-loss patients. Currently, there is inconsistency with the Dutch insurance companies in the indemnity of the costs of body contouring surgery. A better classification can be helpful in preventing this inconsistency. Most classification systems, described in the literature, only pay attention to post-labour patients or aim at only one part of the body.[5-10] The only classification system that addresses the breadth and variety of these specific deformities of the post-bariatric patient is the Pittsburgh Rating Scale (PRS).[11] This classification system was developed and validated in 2005 by the University of Pittsburgh and is meant to be applied in preoperative planning and in evaluating surgical outcomes.

The purpose of this study is to replicate the validation of the PRS classification for contour deformities and to assess its usefulness in the treatment of massive weight-loss patients.

METHODS

Participants

The St. Antonius Hospital in Nieuwegein (The Netherlands) is a designated centre for bariatric surgery. Around 700 interventions are done yearly. All massive weight-loss patients visiting the department of plastic and reconstructive surgery for body contouring were invited to participate in this study. Consistent with the study design of Song et al. we included 25 patients in the study. After 25 patients (20 women, 5 men) gave informed consent, inclusion was closed. Approval from the ethics committee was not

required because patients were not subjected to acts or treatments and their behaviour was in no way imposed upon.

Ten patients lost weight after laparoscopic adjustable gastric banding, nine patients after gastric bypass and four patients due to intensive diet. Two patients underwent laparoscopic adjusting banding followed by gastric bypass because of a disappointing result. All patients visiting the department for body contouring surgery are photographed preoperatively in a standard manner by the department of medical photography of the Antonius Hospital. Photographs were anonymised for this study by non-displaying the faces of the patients.

Data collection

The records of all patients were reviewed retrospectively for demographic data and pre weight-loss data and post weight-loss data.

The PRS is a classification system developed and validated in 2005 by the University of Pittsburgh.[11] A 10-region, four-point grading system has been designed to describe the common deformities found in each region of the body. The grading is descriptive and is illustrated with pictures as well. For each combination of grade and individual region a preferred treatment is suggested. Thirteen observers consisting of three plastic surgeons, three plastic surgery residents (medical specialists), three medical interns at the department of plastic and reconstructive surgery and four nurse practitioners specialised in bariatric surgery (non-medical specialists) underwent personal instruction in the practical use of the PRS with example photographs of the original PRS. Consequently the observers independently completed the PRS on the photographs of the 25 patients. No time limit was given per photograph. A repeat testing with random distribution of the data set was performed by all 13 observers with a time interval of 2 weeks between both tests. Both the surgeons and the residents answered 11 questions about the usefulness and the applicability of the PRS in daily practice.

Statistical analyses

As a measure of inter-observer validity we calculated the intra-class correlation (ICC) with 95% confidence intervals with both subjects and raters considered to be random effects. This ICC can be considered equivalent to the weighted kappa.[12] Consistent with the Pittsburgh study a threshold value of 0.6 for good validity has been used. The ICC was calculated for each region of the body for all observers. Two additional analyses were made: first, the observer group was divided into medical specialists (three plastic surgeons and three experienced residents) and non-medical specialists (four nurses and three medical interns).

In addition we divided the patients group by gender (5 male, 20 female), because the PRS was initially designed for female patients. To determine test-retest reliability, the two tests were also intervalidated by using a weighted kappa measurement.

All statistical methods and analyses were performed in consultation with the statistician of the research department of the hospital.

RESULTS

The 25 included patients lost at least 25% of their initial body weight after bariatric surgery. Their body mass index (BMI) decreased from average 44.6 kg/m^2 (range 33-61.3) to 31.1 kg/m^2 (range 23-44.7) corresponding to a weight decrease from average 133.2 (range 79-203) to 93.4 kg (range 54.3-134.6). All observers completed the PRS for all regions, except for 'buttocks', of all patients twice with at least 2 weeks between both tests.

Validation of classification

The PRS showed an overall mean ICC of 0.577. The regions 'arms' and 'back' showed a good interobserver validity (ICC > 0.6) in both tests: 0.668 and 0.765, respectively and 0.680 and 0.689, respectively. The regions 'abdomen', 'flank', 'buttocks' and 'mons' showed an ICC below 0.6 in both tests. All other regions showed a good validity in only one test (Table 1). In the group of medical specialists an ICC above 0.6 in both tests was seen in five regions (50%): 'arms' (ICC 0.731 and 0.666), 'back' (ICC 0.543 and 0.664), 'hips' (ICC

TABLE 1
Inter-observer validity

	TEST 1 ***Intra Class Correlation***	***95% confidence interval***	***TEST 2*** ***Intra Class Correlation***	***95% confidence interval***
Arms	0.668*	0.529-0.805	0.680*	0.540-0.815
Breast	0.541	0.389-0.709	0.632*	0.491-0.778
Back	0.765*	0.641-0.873	0.689*	0.536-0.830
Abdomen	0.452	0.310-0.650	0.457	0.301-0.650
Flank	0.597	0.457-0.749	0.434	0.292-0.616
Buttocks	0.593	0.420-0.771	0.465	0.289-0.664
Mons	0.468	0.288-0.682	0.455	0.279-0.671
Hips	0.658*	0.520-0.800	0.500	0.339-0.691
Medial thighs	0.653*	0.512-0.795	0.563	0.405-0.731
Lower thighs	0.704*	0.566-0.837	0.573	0.417-0.739

** good validity (>0,6)*

TABLE 2
Inter-observer validity for medical specialists and non medical specialists separately

	Medical specialists		***Non medical specialists***	
	TEST 1	***TEST 2***	***TEST 1***	***TEST 2***
	ICC (95% confidence interval)	***ICC (95% confidence interval)***	***ICC (95% confidence interval)***	***ICC (95% confidence interval)***
Arms	0.731 (0.580-0.854)*	0.666 (0.503-0.812)*	0.612 (0.449-0.772)*	0.682 (0.510-0.825)*
Breast	0.543 (0.369-0.723)	0.664 (0.497-0.810)*	0.594 (0.440-0.754)	0.601 (0.438-0.762)*
Back	0.796 (0.657-0.897)*	0.835 (0.716-0.919)*	0.748 (0.602-0.866)*	0.610 (0.417-0.787)*
Abdomen	0.522 (0.352-0.706)	0.426 (0.239-0.641)	0.432 (0.271-0.625)	0.442 (0.266-0.643)
Flank	0.655 (0.503-0.799)*	0.519 (0.340-0.704)	0.600 (0.446-0.758)*	0.419 (0.260-0.613)
Buttocks	0.464 (0.140-0.720)	N.A.	0.605 (0.430-0.778)*	0.446 (0.262-0.653)
Mons	0.294 (-0.088-0.622)	0.556 (0.177-0.795)	0.457 (0.269-0.670)	0.421 (0.240-0.632)
Hips	0.730 (0.589-0.853)*	0.683 (0.510-0.830)*	0.576 (0.413-0.747)	0.454 (0.287-0.652)
Medial thights	0.677 (0.525-0.817)*	0.663 (0.498-0.810)*	0.592 (0.413-0.747)	0.536 (0.352-0.721)
Lower thigths	0.745 (0.601-0.867)*	0.635 (0.459-0.793)*	0.640 (0.470-0.795)*	0.501 (0.311-0.696)

** good validity (>0,6)*

0.730 and 0.683), 'medial thighs' (ICC 0.677 and 0.663) and 'lower thighs' (ICC 0.745 and 0.635). In the group of non-medical specialists there were only two regions with an ICC above threshold in both tests (20%): 'arms' (ICC 0.612 and 0.682) and 'back' (ICC 0.748 and 0.610) (Table 2).

Different regions showed good validity when using the PRS in men and women. When only female patients were classified, the regions 'arms' and 'back' showed a good validity; alike was seen in the group overall. Using the PRS in male patients, only the region 'lower thighs' showed an ICC above threshold in both tests (ICC 0.816 and 0.690, respectively).

The overall test-retest reliability for all 10 regions has a mean weighted kappa value of 0.523.

Usefulness of the PRS

Most of the specialists acknowledged the necessity of an adequate classification system for patients with massive weight loss. Only two surgeons judged the PRS to be a suitable system for the classification of contour deformities. The two main objections were the lack of consistency of the pictures that currently serve as guidelines for the PRS and the high number of body regions to be rated. Further remarks were made on the lack of a possibility of incorporating the remaining elasticity of the skin in the classification. Sixty-seven percent of the specialists considered the classification scale of 0-3 generally adequate. The abdomen is the only region where a four-scale system was considered insufficient as this region is more complex. The mean time to accomplish the test for all

25 patients was 70 min (range 60-90), which means an average of 2.8 min per patient to classify all 10 regions. A number of regions were suggested to be combined as they were judged to be highly interdependent. The following combinations were suggested: flank-abdomen, buttock-abdomen, flank-abdomen-mons, abdomen-back, abdomen-hips and breasts-flank-abdomen.

The PRS was, for four medical specialists in this study, not a suitable system to link a preferred reconstructive procedure to the level of deformity. The preferred operation is dependent not only on the amount of skin surplus and contour deformity but also significantly on skin elasticity, co-morbidity, previous operations and patient's complaints and expectations.

The usefulness of PRS to evaluate and compare the post-operative outcome to the preoperative situation is supported by four of the six plastic surgeons; the other two were not fully convinced. The usefulness of the PRS classification system as a reimbursement tool for insurance companies was questioned. All plastic surgeons share the opinion that a system such as the PRS can be helpful in providing a cut-off point for insurance companies to decide whether or not to reimburse a body contouring procedure. The surgeons rated level 2 and 3 as severe and advised that coverage of costs by the insurance company should be advocated for this level of deformities.

DISCUSSION

To our knowledge this is the first re-evaluation of the PRS in which we tested the validity and usefulness of this classification system for massive weight-loss patients. In our study, the previous results of PRS could not be reproduced. A mean overall ICC of 0.577 was seen over two tests, correlating to a moderate validity. The PRS scored above the threshold of 0.6 in only two body regions, 'arms' and 'back', and scored consistently lower in all other body regions. Medical specialists scored higher ICCs compared to the non-medical specialists although the overall outcome of the specialists was still not sufficiently high to validate the PRS. A separate analysis for male and female patients showed higher ICCs for females, but only an ICC > 0.6 in both tests was scored in the same two regions 'arm' and 'back' as in the overall assessment.

We used almost the same design as the original study by Song et al.[11] The studies differ however on two points: in our study both medical specialists and paramedics were included in the observer group. The PRS was initially developed for use by medical specialists. Although the nurse practitioners participating in our study had the same 30-min training session as the specialists, they clearly showed a different outcome in the evaluation of contour deformities.

Another difference is that in our study male patients were also included. Although to a lesser extent, male patients also seek plastic surgery after massive weight loss. Therefore we decided to include both females and males to evaluate the PRS for daily practice.

The moderate validity of the PRS found in our study could be influenced by the two above-mentioned differences in study design. The separate analysis of the scores of medical specialists in the observer group and the outcome in the female patients in the study population however did not result in a better validity. As a measure of inter-observer validity we calculated the ICC instead of the weighted kappa. These are considered equivalent and this statistical method cannot be held responsible for the poorer outcome of the PRS in our study.

Most classification systems used in clinical practice serve a number of purposes; primarily they describe and grade anatomical, microscopical or pathological abnormalities.

In the ideal situation a classification system should provide the basis for a treatment algorithm from which the indications for specific interventions can be derived. Finally a classification could divide patients into different prognostic groups and allow outcome comparison between different patient groups or institutions. Good examples of such widely used classification systems serving these purposes are the Arbeitsgemeinschaft für Osteosynthesefragen (AO) fracture classification and the Union for International Cancer Control tumour node metastasis (UICC TNM) classification for cancer staging.[13,14]

The increasing demand for post-bariatric plastic surgery requires, in our opinion, a similar type of classification for the optimal treatment of these complex patients. The first step is an objective description of the anatomical deformities. The descriptions of the PRS are subjective such as 'normal', 'adiposity', 'excessive adiposity' or 'severe adiposity', and they focus on 'adiposity' whereas massive weight-loss patients mainly have a skin problem. Bozola et al. also emphasise focussing on more specific descriptions and measurable characteristics (e.g., fat deposit, musculo-aponeurotic layer and amount of skin) to make the grading less dependent on the observers' interpretation.[15] Iglesias et al. designed a classification system using fixed anatomic references and objective measurements.[16] The system measures the redundant pannus in relation to the inguinal ligament and the total length of the thigh, for example. The separate classification of 10 regions makes the PRS extensive and time consuming, which remains a drawback of this scoring system as mentioned by Al Aly.[17]

Besides a description of anatomical deformities an adjusted classification should include subjective patient-related parameters such as hygienic and functional impairments and physical or emotional disability. Gurunluoglu et al. describe a classification of redundant abdominal tissue after massive weight loss, which is based on the existence of chronic skin problems and the associated activities of daily living (ADL) interference.[18]

Chronic skin problems could lead to additional medical costs and interference in ADL might negatively impact quality of life, further weight loss and return to work. The reduction of functional problems should be the primary goal of post-bariatric plastic surgery and the impact of skin surplus on physical functioning and quality of life should therefore be included in the classification of post-bariatric skin deformities. This could be measured with an obesity-specific questionnaire, such as the Bariatric Analysis Reporting Outcome System (BAROS) or Moorehead-Ardelt Quality of Life Questionnaire or a more general health and well-being indicator, the 36-Item Short Form Health Survey (SF-36).

Although the PRS combines a classification of deformities with preferred treatments it oversimplifies a complex situation. The vast number of different operative techniques described in the literature indicate that there is no 'best' treatment for different types of contour deformity at present. The preferred techniques remain mainly dependent on the preference and experience of the individual surgeon. It therefore remains to be seen whether it will be realistic to aim for a concise (surgical) treatment algorithm that can be derived from a classification system. In our opinion a rating scale should focus more on indication and less on surgical technique.

The benefits of body contouring must outweigh the potential risks of complications in the decision for body contouring surgery. One has to appreciate that post-bariatric patients with severe weight loss generally have a greater operative risk than patients with the same weight who have never been obese. With the increasing popularity of gastric bypass surgery for instance, an increasing number of these patients suffer from nutritional deficiencies. Besides, many post-bariatric patients are still overweight (BMI > 30 kg/m^2) and have co-morbidities such as diabetes and hypertension and these risks are reflected in the high percentage of complications in body contouring surgery (20-66%).[19,20] As we demonstrated in a previous study the complication rate following reconstructive surgery is associated with a stable weight prior to surgery and a BMI below 30 kg/m^2.[19] It seems logical to include patients' co-morbidities and risk factors such as smoking in a future classification system.[20]

The PRS is a predominantly descriptive and deformity-based classification and in the Netherlands frequently used by insurance companies as a basis for reimbursement of post-bariatric plastic-surgical procedures for individual patients. In our opinion the PRS does not meet today's requirements to make valid decisions about the indication and reimbursement for post-bariatric body contouring.

As outlined above, a new classification system should combine an objective description of anatomical deformities with a grading of the patient's discomfort and suffering from a particular deformity and include risk factors of complications following body-contouring

surgery. A classification based on these three components will allow a realistic preoperative inventorisation of risks and benefits of post-bariatric reconstructive surgery and provide transparent and unbiased parameters for the indication of post-bariatric surgery of the benefit for plastics surgeons and insurance companies alike. Besides this, validated measurements of anatomical deformities and quality of life allow outcome comparison in time and between different patient groups.

CONCLUSIONS

In this study we could not consistently reproduce and validate the results of the PRS for the classification of contour deformities of massive weight-loss patients. A future classification system should encompass, besides anatomical parameters, items such as functional disability and hygienic impairment scores and peri-operative risk factors for the individual patient.

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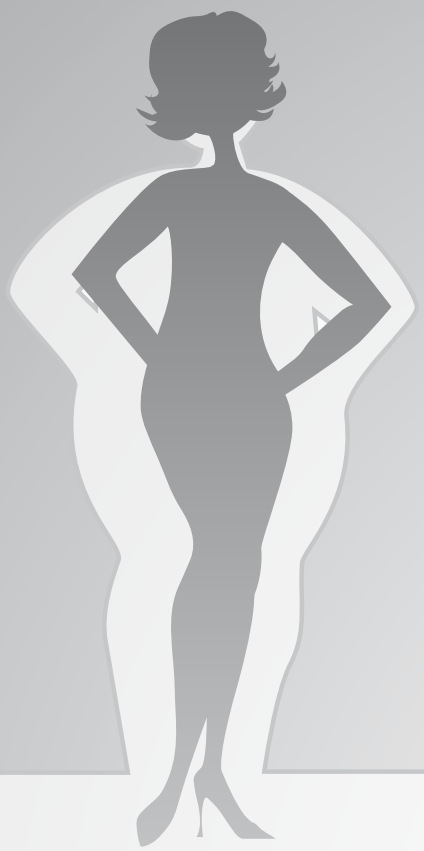

Chapter 4

The Screening of Motives, Barriers and Expectations regarding Body Contouring Surgery in Post-Bariatric Patients.

Optimization of Treatment Decision and Preoperative Counseling

Submitted

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ABSTRACT

Background

When weighing the pros and cons of body contouring surgery in post-bariatric patients, it is mandatory to consider besides anatomical parameters and risk factors the needs and beliefs of individual patients. The objective of this study was to offer a comprehensive overview of motives for and barriers to body contouring surgery as well as expectations regarding the post-operative result to be used in screening of candidates for body contouring surgery.

Methods

In-depth interviews with post-bariatric patients yielded statements about motives, barriers and expectations regarding body contouring surgery. Patients individually sorted these statements according to similarity. Hierarchical cluster analysis was applied to categorize homogenous statements in groups (clusters).

Results

Cluster analyses yielded three hierarchical structures of 47 motives, 17 barriers, and 46 expectations. Motives were categorized in three major clusters: 'physical appearance', 'social impact', and 'psychosomatic impact'. 'Skin problems' was the most important motive. 'Barriers' were categorized in the major clusters 'investment' (including financial and mental costs), and 'outcome' (including fear for surgery and a negative outcome); 'financial costs' was the most important barrier. Expectations comprised ten clusters referring to physical, psychological, and social expectations; 'positive affect' was the most important expectation. A checklist was developed that can be used in pre-operative counselling.

Conclusions

The checklist of motives, barriers, and expectations regarding body contouring surgery can be used as a brief screening instrument to identify needs and wishes important to individual patients and to identify realistic and unrealistic expectations regarding the outcome of body contouring surgery.

INTRODUCTION

Bariatric surgery, the most effective treatment for extreme obesity, is associated with massive weight loss, decrease of co-morbidity and improved quality of life.[1-2] A negative consequence of massive weight loss is a lax, overstretched skin which can result in physical and psychological discomfort and hygienic problems.[3-6]

The increasing demand for post-bariatric body contouring surgery is accompanied by a debate by professionals, patients and health care insurance companies about the indication for body contouring surgery. It should be based on objective considerations such as anatomical deformities and risk factors for complications as well as subjective considerations such as patients' discomfort and suffering.[7] The needs and beliefs of individual patients should be considered as well as expectations regarding the treatment outcome. Body contouring surgery can be seen as functional surgery that relieves the negative consequences of hanging skin. Apart from physical problems, psychological concerns can be a reason to seek body contouring surgery, such as body image dissatisfaction and shame.[3,8,9] Although many patients are motivated for surgery, there are barriers as well.[4,5,10-12] Potential barriers are low reimbursement [4,10,13], scars after body contouring [3,8], lack of information regarding treatment options and complications, judgment of other people, lack of support for surgery from relatives and the belief that elective plastic surgery is risky.[3,13] Although many studies describe motives for and barriers to body contouring, most studies either focus on single aspects[4,10,12-13] does not pay attention to the perspective of patients[14], include (only) post-body contouring patients[3-5,12], examined non-bariatric patients[15,16] or use (not validated) questionnaires with low response rate.[5,10,12-13] As yet an encompassing overview of motives and barriers to body contouring surgery from the perspective of post-bariatric patients by a combined qualitative and quantitative approach is lacking.

Patients' expectations of the aesthetic result and physical and psychosocial benefits should also be taken into account in the decision about body contouring surgery. Patients may unrealistically believe that surgery will result in a far better body appearance, self-confidence and social or intimate relationships.[10] A screening instrument to check these expectations may prevent that patients submitted to operation finally are disappointed about the outcome.

The aim of this study in post-bariatric patients was to identify a comprehensive set of motives, barriers, and expectations regarding body contouring surgery. Firstly, open-minded, in-depth interviews were completed to obtain an extensive overview of motives, barriers, and expectations from the perspective of patients. Secondly, a card sorting task was used to let patients individually sort the statements derived from the interviews according to similarity and relevance. Finally, a hierarchical cluster analysis was used to structure the reasons. Based on the outcome of the analysis a preliminary checklist is proposed to be used as an additional pre-operative screening instrument.

METHODS

Participants

Participants were recruited in the Bariatric Surgery outpatient department of the St. Antonius Hospital in Nieuwegein in March and April 2011. Participants 15-28 months after bariatric surgery were included. Exclusion criteria were previous body-contouring surgery, psychological disorders, and low proficiency in Dutch language.

Nine participants (7 women, 2 men) were interviewed. The interviews with the last two participants did not yield new information. Thirteen subjects participated in the card-sorting task. A sample size between 10 and 20 people has been suggested to be a workable number as a resembling study involving 168 subjects found that clusters were very similar to sample sizes between 20 to 30. [17]

Procedure

A combination of qualitative and quantitative methods consisting of interviews, a card-sorting task, and hierarchical cluster analysis was applied.[18] The study was conducted according to the principles of the Declaration of Helsinki (6th revision, Seoul 2008). All participants provided written informed consent. Approval by an ethics committee was not necessary for this non-experimental and non-invasive study.

Interviews

The interviews were carried out at the home of participants and were audio-taped. A combined open and semi-structured interview was used. Open questions were: "What could be your reasons to choose body contouring surgery?" (motives), "What could be reasons for you not to choose body contouring surgery?" (barriers), and "What do you expect to change after body contouring surgery?" (expectations). Furthermore, patients were asked to think of motives, barriers, and expectations pertaining to five domains: economic, biomedical, social, psychological, and physical appearance. The number of interviews was set by the moment that no new topics emerged during interviews with 2 successive participants.

Statements from the interviews were independently evaluated by 4 members of the research team using four criteria. Firstly, it was checked whether the statements really related to body contouring surgery. Secondly, statements that were ambiguous, abstract or could not be generalized to the entire group were removed. Thirdly, overlapping statements were combined and statements including multiple assertions were divided. Finally, all statements were modified to a positively phrased sentence to avoid double negatives complicating interpretation. The final statements fitted the formats "a reason for choosing body contouring surgery is…", "a reason not choosing body contouring surgery is…", and "an expected outcome of body contouring surgery is…". The selected

statements were then numbered and written on separate cards for use in the card sorting task.

Card-sorting

In the card sorting (Q-sort) task participants categorized the statements that were derived from the interviews. All participants did the task at home in the presence of one member of the research group. There were 2 types of tasks.

In the first task, participants individually categorized the cards with the statements into categories according to similarity of meaning. This task was done for motives, barriers and expectations separately. The following rules applied for the categorizing: all statements had to be placed in a pile; each statement could be placed in one pile only; a minimum of 4 and a maximum of 12 piles had to be formed, and each pile could contain 2 to 25 statements.

In the second task, participants individually categorized the cards into 5 piles based on the extent to which they considered the statements to be the least (pile 1) to most (pile 5) important. This task was again done for motives, barriers and expectations separately. The following rules applied: each statement could be placed in one pile only; exactly 5 piles should be formed with statements equally distributed across the piles. The tasks were performed at a table. Participants wrote the results on a score form.

Statistical analysis

Cluster analysis is a statistical technique to classify objects of a similar kind into clusters.[19] Hierarchical cluster analysis (Ward's method, squared Euclidean distances) in SPSS statistical software version 17.0 (SPSS, Chicago, IL) was used to classify statements that were individually sorted by the participants according to similarity of meaning in a hierarchy of clusters. The main criterion to decide on the number of clusters was that the clusters should reflect distinct components of motives, barriers and expectations. The final number of clusters was set by the researchers based on interpretation of the table (agglomeration schedule) and figure (dendogram) produced by the statistical software program, showing which statements are being combined at each stage of the hierarchical clustering process.[18] In the first stage we used a top-down interpretation starting with two clusters, then three and so on until additional clusters did not yield new content. In the second stage, the contents of both a lower and a higher number of clusters were compared to finally decide on the number of clusters.

Using scores of the second sorting task, we calculated for each statement and cluster of statements a mean score reflecting the importance of the motive, barrier or expectation for the participants.

RESULTS

Participants

The mean duration of the interviews was 93 minutes (range 55-150 minutes, SD 30). Nine participants (7 women, 2 men) were interviewed, they had a mean age of 50.0 years (range 39-59; SD 8.7). Six participants were married, three were single. Two participants had undergone laparoscopic gastric banding (LAGB), six participants laparoscopic gastric bypass surgery (LRYGB) and one participant a sleeve gastrectomy (SG). The mean Body Mass Index (BMI) of 55.3 kg/m^2 (SD 2.4, range 53.6-57.0) before bariatric surgery was reduced to 34.0 kg/m^2 (SD 4.9, range 30.5-37.4) after a mean interval of 21 months (SD 3.3, range 17-25) since bariatric surgery. The education level was low (primary school, lower vocational secondary) for three participants, medium (intermediate general secondary, intermediate vocational) for four participants and high (high general secondary, high vocational, pre-university, university) for two participants.

Thirteen participants (9 women, 4 men), with a mean age of 47.0 years (SD 10.7, range 34-65), participated in the card sorting task; two of them had also participated in the interviews. The mean duration of the card sorting task was 81 minutes (SD 30.5, range 35-120). Nine participants were married, four were single. Three participants had undergone LAGB, eight LRYGB, and two SG. The mean BMI before bariatric surgery of 48.3 kg/m^2 (SD 6.5, range 42.0-59.4) was reduced to 31.7 kg/m^2 (SD 3.6, range 26.1-37.5) kg/m^2 after a mean average interval of 22.0 months (SD 4.3, 16-27) since bariatric surgery. The education level of participants was low for four participants, medium for four participants and high for five participants.

Interview statements

A list of 182 statements was derived from the interviews. After evaluation and selection by the research team, 110 statements remained, 47 motives (table 1), 17 barriers (table 2), and 46 expectations (table 3).

TABLE 1
The seven clusters of motives for body contouring surgery with the mean importance rating (and standard deviation) of each cluster and statement. All statements started with "A reason for choosing body contouring surgery is…"

	Importance	
	Mean	(SD)
Cluster 1. Physical appearance	**2.80**	**0.59**
…wanting to look different	3.00	1.53
…finding looks important	2.69	1.30
…as a reward for loosing weight	2.54	1.20
…satisfaction with weight loss	3.08	1.26

TABLE 1 (continued)

	Importance	
	Mean	(SD)
…wanting a tauter body	3.08	1.26
…to complete the treatment	2.77	1.59
…to be able to buy nicer clothes	2.62	1.04
…to be able to buy different clothes	2.54	1.13
…to be sexually attractive	2.85	1.46
…to be motivated to eat healthily	2.54	1.33
…to be able to buy clothes that fit more easily	3.08	1.12
Cluster 2. Shame	**2.73**	**1.38**
…being scared for going swimming	2.69	1.55
…being stared at	2.77	1.64
Cluster 3. Social pressure	**2.00**	**0.46**
…because my partner wants me to	2.00	1.08
…because my partner finds me less attractive	1.85	0.99
…because others are ashamed for me	1.38	0.96
…someone else's recommendation	1.23	0.44
…still looking fat because of excess skin	3.54	1.66
Cluster 4. Encouragement	**2.33**	**0.61**
…the good experience of others with body contouring surgery	2.15	0.90
…the support of those around me	2.54	0.97
…to be attractive for others	2.31	1.25
Cluster 5. Psychological distress	**3.51**	**0.65**
…being ashamed of my body	4.08	1.12
…discomfort	3.54	1.05
…insecurity	3.46	1.27
…fear that others can smell the skin folds	3.00	1.87
…feeling bad	3.23	1.42
…dissatisfaction with my body	3.54	1.13
…finding my body ugly	3.92	1.04
…feeling unattractive	3.31	1.38
…difficulty doing sports	3.23	1.48
…being unhappy	3.69	1.38
…exasperation	3.15	1.46
Cluster 6. Physical impairment	**3.23**	**1.09**
…difficulty moving	3.38	1.46
…difficulty bending down	3.23	1.54
…my sex life which is suffering	2.77	1.09
…poor health	3.54	1.45
Cluster 7. Skin problems	**3.98**	**0.79**
…itchy skin	4.00	1.35

TABLE 1 (continued)

	Importance	
	Mean	(SD)
…smelly patches under the skin folds	3.54	1.61
…an overhanging tummy	4.38	0.96
…inflamed skin folds	3.31	1.75
…irritated skin	4.15	1.07
…excess skin	4.46	0.66
…skin folds that are a constant reminder	4.54	0.66
…excess skin that gets in the way	4.77	0.44
…having to spend time every day caring for irritated skin	2.85	1.77
…painful skin folds	3.85	1.46

TABLE 2
The six clusters of barriers to body contouring surgery with the mean importance rating (and standard deviation) of each cluster and statement. All statements started with "A reason not to choose body contouring surgery is…"

	Importance	
	Mean	(SD)
Cluster 1. Defeated	**2.20**	**0.75**
…having accepted that I am what I am	2.77	1.30
…shame	2.15	1.28
…having other priorities	2.38	1.50
…other people's discourage	1.85	0.99
…already having been through enough	1.85	1.46
Cluster 2. Financial	**4.54**	**0.97**
…having to pay for the surgery	4.46	1.05
…the high costs	4.62	0.96
Cluster 3. Mental	**3.15**	**1.41**
…mental vulnerability	3.15	1.41
Cluster 4. Surgery	**3.21**	**1.09**
…fear of the operation	2.85	1.52
…the risks linked to the operation	4.00	1.00
…fear of the anesthetic	2.77	1.36
Cluster 5. Negative outcome	**2.72**	**0.81**
...scarring	2.62	1.04
…a disappointing outcome of the operation	3.23	1.30
…that a healthy body would be cut open	2.31	1.25
Cluster 6. Recovery	**3.10**	**0.88**
…the recovery period after the operation	3.23	1.17
…being out of circulation for a while	2.92	1.44
…poor health	3.15	1.86

TABLE 3
The ten clusters of expectations regarding body contouring surgery with the mean importance rating (and standard deviation) of each cluster and statement. All statements started with "An expected outcome of body contouring surgery is…"

	Importance	
	Mean	(SD)
Cluster 1. Negative affect	**2.08**	**1.14**
…to be disappointed	2.17	1.27
…to be dissatisfied	2.00	1.21
Cluster 2. Positive affect	**3.97**	**0.53**
…a feeling of relief	4.08	0.79
…to be happy	4.17	1.03
…to be self-confident	4.08	1.00
…to be more carefree	3.25	1.42
…a good feeling	4.42	0.79
…to feel proud	3.83	1.27
Cluster 3. Economic	**2.08**	**1.06**
…a difficult financial situation	2.33	1.50
…to regret spending the money	1.83	1.03
Cluster 4. Partner	**2.89**	**1.00**
…to be found attractive to my partner	2.5	1.24
…to have a better relationship	2.33	1.44
…to still be the same person	3.83	1.40
Cluster 5. Appearance	**2.69**	**0.62**
…to be physically healthier	3.25	1.77
…to no longer have skin folds	3.50	1.57
…to be treated differently	2.67	1.37
…to be found attractive to others	2.33	1.23
…to be given compliments	2.75	1.42
…to have scars	2.25	1.55
…to look like someone who used to be too fat	2.08	1.00
Cluster 6. Confidence	**2.81**	**0.74**
…to find a partner	2.08	1.44
…to have a better sex life	2.50	1.00
…skin that is easy to care for	2.83	1.40
…to have a cleaner body	2.92	1.62
…to be able to stand up for myself better	2.67	1.07
…to dare to show my body	3.83	1.34
Cluster 7. Change	**3.14**	**0.70**
…to look at my body differently	3.08	1.17
…to look better	3.58	1.17
…to have completed the treatment	2.75	1.42

TABLE 3 (continued)

	Importance	
	Mean	(SD)
Cluster 8. Attractiveness	**3.08**	**0.73**
…to look more normal	3.5	1.38
…to look more beautiful	3.67	1.16
…to have undergone a metamorphosis	2.08	1.17
Cluster 9. Fashionable	**3.27**	**0.93**
…to be able to wear nicer clothes	2.83	1.27
…to be able to wear smaller clothes	3.08	1.31
---to be able to wear different clothes	3.00	1.21
…to be able to wear clothes that fit better	3.42	1.00
…to be slimmer	3.58	1.68
…to have a tauter body	3.83	1.34
…to be attractive	3.17	1.12
Cluster 10. Fitness	**3.42**	**1.24**
…to be more mobile	3.42	1.24
…to be able to do more	3.50	1.38
…to be able to go swimming	3.17	1.70
…to be able to do sports	3.50	1.31
…to be able to bend down more easily	3.42	1.51
…to be more flexible	3.50	1.51

Sorting Task

The number of piles across the participants varied from 4 to 8 (motives), 4 to 6 (barriers), and 4 to 9 (expectations).

Hierarchical cluster analysis

Motives

Hierarchical cluster analysis of the 47 motives yielded seven clusters of statements, which are shown on the right of Figure 1. Decreasing this number to six would combine the clusters 'shame' and 'social pressure', which reflect distinct intrinsic and extrinsic motives. Increasing the number to eight would divide the cluster 'psychological distress', which comprised similar motives.

The hierarchical solution shows a major higher-order distinction between 'physical appearance' and 'adverse consequences'. The cluster 'physical appearance' included statements about the benefits of body contouring surgery for outward looks. 'Adverse consequences' comprised six clusters with motives regarding 'social impact' and 'psychosomatic impact'.

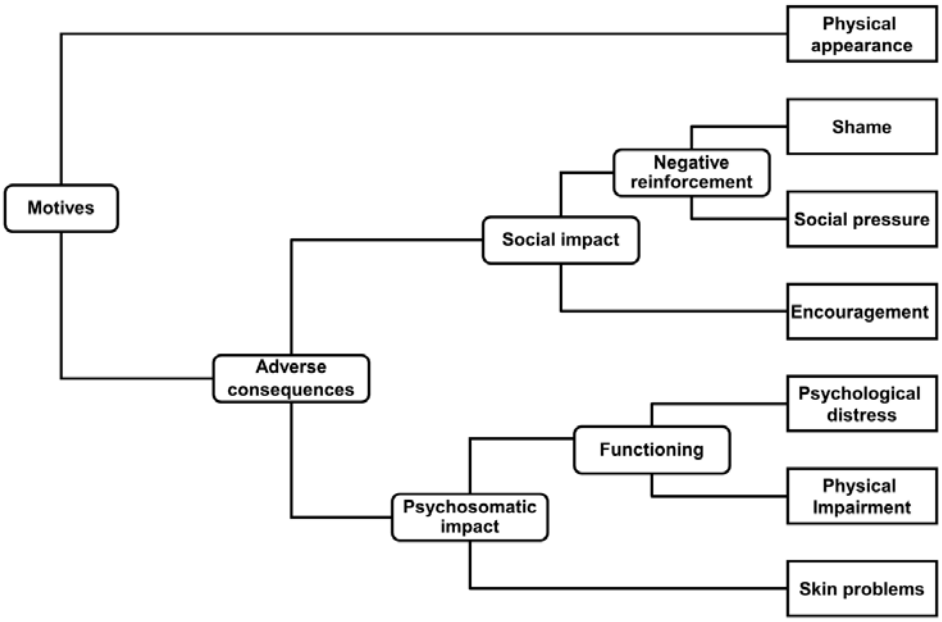

FIGURE 1
Hierarchical cluster analysis of the 47 motives regarding body contouring surgery

The seven final clusters with statements are shown in Table 1. The higher means represent the more important motives according to the participants. With a mean rating of 3.98, "skin problems" were considered the most important motive to choose body contouring surgery. "Social pressure" was considered the least important cluster of motives.

Barriers

Figure 2 shows the outcome of hierarchical cluster analysis of 17 statements about barriers to body contouring surgery. The number of clusters was set at six. Decreasing this number to five would combine the clusters 'mental' and 'financial' costs that differentiate material and immaterial costs. Increasing the number of clusters to seven would separate the adequately fitting single statement 'already having been through enough' from the cluster 'defeated'.

The barriers were categorized in two broad categories, 'investment' and 'outcome'. Investment referred to being 'defeated', i.e., already having suffered too much, and 'financial' and 'mental' costs. 'Outcome' referred to fear for surgery, anaesthetics and a negative outcome of surgery.

The six clusters with all statements and the level of importance are shown in Table 2. The high financial costs were considered by far the most important barrier. Statements in the cluster "defeated" were rated least important (M = 2.20).

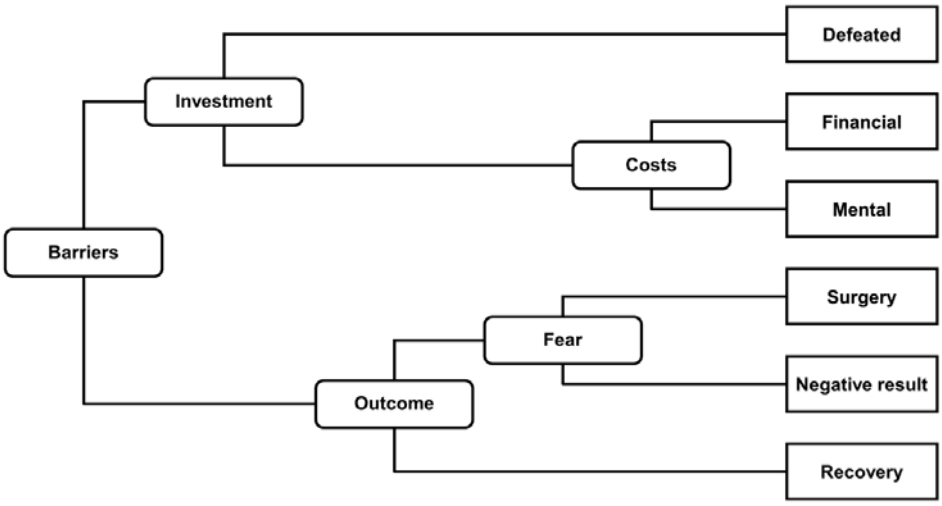

FIGURE 2
Hierarchical cluster analysis of 17 barriers regarding body contouring surgery

Outcome Expectations

Hierarchical cluster analysis of the 46 statements about outcome expectations yielded ten clusters of statements (Figure 3). Decreasing this number to nine would combine the clusters "fashionable" and "attractiveness" which reflect distinct expectations concerning clothes and looks. Increasing the number of clusters to 11 would split the statements "finding a partner" and "having a better sex life" from the "confidence" cluster. The statements belong together, however, because both reflect confidence about physical aspects of social interaction as contrasted with psychological aspects of social interaction with the partner that are categorized in the "partner" cluster of the "family" cluster.

The two main categories reflected 'physical' and 'psychosocial' outcome expectations. The 10 clusters with all statements are shown at the right in Table 3. The cluster "positive affect" is considered most important in terms of expectations. "Economic" and "negative affect" are both seen as least important.

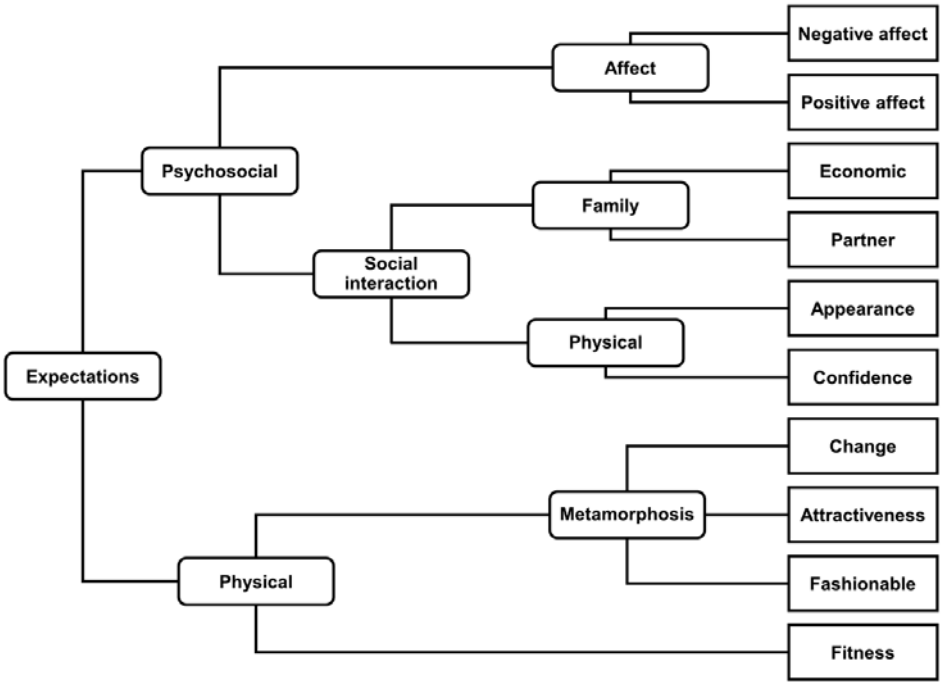

FIGURE 3
Hierarchical cluster analysis of the 46 expectations regarding body contouring surgery

Screening Instrument

The results of the study were used to develop a preliminary checklist that can be used as a screening instrument in pre-operative counselling. Using the checklist, the patient chooses and prioritizes three motives, barriers and expectations that he or she considers most important (Table 4).

TABLE 4
Checklist to clarify individual motives, barriers and expectations regarding body contouring surgery in patients after bariatric surgery

Motives. Prioritize in the list below your three most important reasons for choosing body contouring surgery. Give ranks 1, 2 and 3 for the three motives that you consider most important	
☐ **Physical appearance**, e.g. to look different, to be sexually more attractive, to be able to buy clothes that fit more easily	
☐ **Shame**, e.g. to be no longer scared for going swimming, to no longer being stared at	
☐ **Social pressure**, e.g. because my partner wants me to, because of someone else's recommendation	
☐ **Encouragement**, e.g. because others had good experience with body contouring, because of the support of those around me	
☐ **Psychological distress**, e.g. to reduce being ashamed, insecure, unhappy, and so on	
☐ **Physical impairment**, e.g. to be better able move and bending down, to improve health	
☐ **Skin problems**, e.g to get rid of itchy or inflamed skin or pain, to reduce the everyday care for irritated skin	
Barriers. Prioritize in the list below your three most important reasons to <u>not</u> choose body contouring surgery. Give ranks 1, 2 and 3 for the three barriers that you consider most important	
☐ **Defeated**, e.g. shame, other people's discourage, already having been through enough	
☐ **Financial**, e.g. having to pay for the surgery, high costs	
☐ **Mental**, e.g. mental vulnerability	
☐ **Surgery**, e.g. fear of the operation, fear of the anesthetic, risks linked to the operation	
☐ **Negative outcome**, e.g. scarring, disappointed outcome	
☐ **Recovery**, e.g. the recovery period, being out of circulation, poor health	
Expectations. Choose in the list below the three aspects that are most likely to change after body contouring surgery according to you. Give rank 1, 2 and 3 for the three changes that will most likely occur according to you	
☐ **Negative affect**, e.g. to be disappointed or dissatisfied	
☐ **Positive affect,** e.g. to be happy or self-confident, feeling of relief, to be proud	
☐ **Economic**, e.g. a difficult financial situation, regret spending the money	
☐ **Partner**, e.g. being attractive to my partner, to have a better relationship	
☐ **Appearance**, e.g. physically healthier, to be found attractive to others, to be treated differently	
☐ **Confidence**, e.g. to find a partner, have a better sex life, to be able to stand up for myself	
☐ **Change,** e.g. to look better, to look at my body differently	
☐ **Attractiveness,** e.g. to look more beautiful. To look more normal, a metamorphosis	
☐ **Fashionable**, e.g. to wear nicer or smaller clothes, to be slimmer	
☐ **Fitness**, e.g. to be more mobile, to be able to do sports or to do more	

DISCUSSION

Post-bariatric surgery patients experiencing massive weight loss are in particular motivated for body contouring surgery due to physical and hygienic skin problems, they are hold back by costs of surgery, and they expect changes in psychological status and social relations post-operatively. Individual patients though, differ with respect to motives, barriers and expectations. This study identified a wide range of reasons for and against choosing body contouring surgery after massive weight loss and outcome expectations which can be used to optimize preoperative counselling.

Motives

The extensive overview of motives for body contouring surgery including dissatisfaction with excess skin, functional consequences, physical appearance and social impact as set out in the current study adds to previous studies.[3,8] The social impact cluster contains both encouragement (being supportive to body contouring surgery) and negative reinforcement, which means that the motivation to seek body contouring surgery is motivated by the belief that the surgery takes away the situation of being negatively treated by the partner or others. These motives add to the social pressure motive mentioned in a previous study reporting that patients are held back from surgery by the judgment of other people and unsupportive family[3], in agreement with our barrier item "other people's discourage". To prevent disappointment after the operation, it is of great importance to clarify whether patients really want the operation themselves or only want to satisfy the needs of others.

Barriers

Financial costs, fear for surgery and poor recovery, and mental vulnerability were mentioned as barriers to choose body contouring surgery. High financial costs have been noted a barrier in previous literature.[11,13] As people eligible for bariatric surgery generally have a lower income[14] and reimbursement for body contouring surgery is low, there is a discrepancy between the desire for body contouring and the actual performed procedures.[4,8,12] Fear for complications has previously been suggested to be a possible barrier[4], but our study is the first empirical confirmation in which fear for surgery, anaesthesia and poor recovery are seen as barriers to body contouring surgery. Scarring can function as a barrier as well.[3,10,12] Clear preoperative education about the operation and recovery could overcome fears that emerge from lack of information or unrealistic beliefs.

On average, skin problems and financial costs were considered the most important reasons to choose or not choose body contouring surgery. However, motives for and barriers to body contouring surgery may vary widely from patient to patient.

Expectations

Patient's outcome expectations did not give a one-to-one reflection of patients' motives and barriers to seek body contouring surgery. Important expectations were positive affect, fitness, and being more fashionable and attractive. These anticipated outcomes are likely attributed to removing loose hanging skin.[5,10]

Improvement in quality of life is expected after bodycontouring surgery [10], but the observation of improvement has been limited to physical functioning [20] or to the first post-operative years in most studies.[21] A single study with a small sample suggested a long-term improvement in quality of life.[22] If excessive skin withholds a patient from physical activity, the patient will benefit from body contouring surgery.[3,20] There are however patients that pursue bodycontouring surgery for its anticipated positive effects on relationships or depressive mood.[3,8,10-11] Some statements such as "An expected outcome of body contouring surgery is …to find a partner", "…to be treated differently" or "…to have a better relationship" reflect that at least some patients may anticipate such an effect. These expectations could be gleaned from internet or cosmetic surgery television.[13,16] Such programs present surgery and its outcomes in a distorted and glamorized manner, which may fuel unrealistic expectations of patients.[8] Dissatisfaction with the post-operative result has been reported [12,20,23] and evaluation of post-operative results by patients is less positive compared to evaluations by the surgeon.[12,24]

The current study underlines the importance of a thorough preoperative assessment of patients' realistic and unrealistic expectations of the functional and aesthetic change after surgery.[13,20] Drawing the potential scars on the body and showing post-operative results can be helpful to give a realistic impression of what can be expected after surgery.

The strength of the current study is the use of an inductive, open-minded approach to find a diversity of possible motives, barriers, and expectations concerning body contouring surgery. In the interviews with nine participants the chance of finding many different reasons was large because the group of interviewees was a varied group. For card sorting a sample size between 10 and 20 people has been suggested to be a suitable number although a sample size between 20 and 30 would have been a safer choice.[17] A limitation is the inclusion of two participants in both the interviews and the card sorting task. However, these two parts of the study appealed to distinct knowledge and abilities of subjects. Future studies should evaluate the implementation of the proposed checklist in clinical practice.

Key to successful patient outcome in body contouring surgery is to outline a realistic impression of the risks and benefits of surgery.[8] Professional considerations concerning anatomical deformities, the type of operation and risk factors for complications should be made and subjective needs and beliefs of the patient should be assessed and taken

into account. The checklist as proposed in this study may prove a useful instrument to provide insight in patients' individual motives, barriers and expectations towards body contouring surgery and may contribute to optimize the pre-operative counselling. A deliberate decision whether the individual patient is a suitable candidate for body contouring surgery will thus improve the care for the post-bariatric patient.

CONCLUSION

This study offers an encompassing overview of bariatric patients' motives, barriers and expectations regarding body contouring surgery that can be used by the plastic surgery team for screening considerations of individual patients. Subsequently, subjective motives, barriers and (realistic and unrealistic) expectations can be matched to the realistic prospective result as appraised by professionals. By using this screening procedure patients and health care professionals can together take an informed decision about the need for body-contouring surgery.

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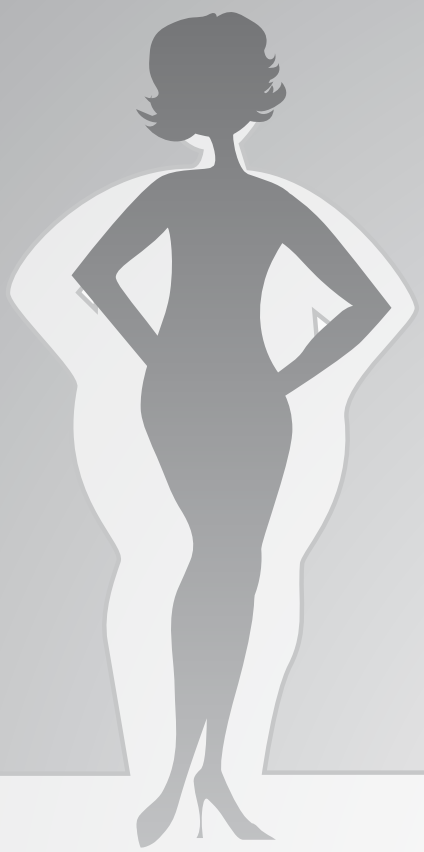
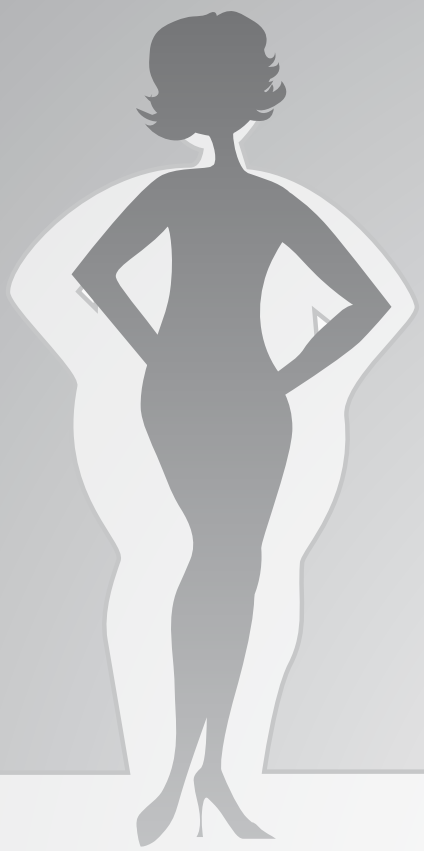


Part II

Quality of Life



Chapter 5

The Impact of Reconstructive Procedures following Bariatric Surgery on Patient Well-being and Quality of Life

Obesity Surgery 2010; 20: 36-41

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ABSTRACT

Background

Massive weight loss following bariatric surgery may lead to an excess of lax, overstretched skin, causing physical discomfort which may affect the patient's quality of life. Whereas the functional and aesthetic deformity is an expected result of massive weight loss, the role of the plastic surgeon in the multidisciplinary approach of the morbidly obese is still unclear. The purpose of the current study is to evaluate the results of reconstructive surgery following weight loss surgery, focusing on the impact on the physical and psycho-social well-being and quality of life of patients.

Methods

Out of a group of 465 patients, 61 patients underwent reconstructive surgery following weight loss surgery. In 43 respondents, the quality of life after reconstructive surgery was measured by the Obesity Psychosocial State Questionnaire. Patient satisfaction was evaluated.

Results

Reconstructive surgery resulted in a significant improvement in quality of life in patients at a mean interval of 42 months between weight loss and reconstructive surgery. The most frequent procedures were abdominoplasty and breast reconstruction. The relative high complication rate of 27.9% was of no influence on quality of life and the majority of the patients (67%) were satisfied with reconstructive surgery.

Conclusions

This study shows that reconstructive surgery following weight loss after bariatric surgery results in a significant improvement in overall quality of life. Reconstructive surgery should be incorporated in the multidisciplinary care program following weight loss surgery in the morbidly obese patient.

INTRODUCTION

The worldwide obesity epidemic is becoming a major health problem. In recent years, a growing number of morbidly obese patients are seeking a surgical solution for their weight problem. Bariatric surgery is the only effective treatment for morbidly obese patients resulting in a substantial and long-term weight reduction with a concomitant significant improvement in overall quality of life.[1-4]

Massive weight loss following surgery leads to an excess of lax, overstretched skin, causing physical discomfort and psycho-social problems, which may negatively affect the patients' quality of life.[5] The changes in physical appearance and functioning may also impede a further weight reduction or may even lead to weight regain.[6] Whereas the functional and aesthetic deformity is an expected result of massive weight loss, the role of the plastic surgeon in the multidisciplinary approach of the morbidly obese is still unclear.

The purpose of this study is to evaluate the role of reconstructive surgery following weight loss surgery in the treatment of morbid obesity, with special emphasis on its impact on the physical and psycho-social well-being and quality of life of the patients.

METHODS

Patients

During the period November 1995 to April 2005, 465 patients underwent surgery for morbid obesity at the St. Antonius Hospital in Nieuwegein. Of these patients, 61 (13.1%) underwent body contouring surgery in the same clinic following massive weight loss. These patients were included and asked to participate in the study.

Quality of Life Measurements

Following informed consent, the patients completed a questionnaire to analyze the effect of reconstructive surgery on quality of life. The actual and past psychosocial states were measured by the Obesity Psychosocial State Questionnaire (OPSQ; Table 1).[7] The questionnaire measures seven domains: 'physical functioning' (15 items), 'mental well-being' (six items) 'physical appearance' (nine items), 'social acceptance' (four items), 'self-efficacy toward eating and weight control' (three items), 'intimacy' (four items) and 'social network' (two items). Table 1 shows examples of every scale of the OPSQ. For the purpose of this study, we used 31 items of the Obesity Psychosocial State Questionnaire. All scales still have a moderate to high reliability after modification. The questionnaire has a five-point rating scale, ranging from 1 (almost never) to 5 (almost always). A lower score on a psychosocial state reflects less problems on that domain and corresponds

TABLE 1
Example items of the Obesity Psychosocial State Questionnaire (OPSQ)

Scales	***Items***
Physical functioning	To kneel or to duck easily
Mental well-being	To feel depressed (reversed score)
Physical appearance	To feel fatty when someone takes a picture (reverse score)
Social acceptance	To be discriminated because of my weight (reverse score)
Self-efficacy	To feel helpless toward my eating behaviour (reversed score)
Intimacy	To have sexual problems because of my weight (reversed score)
Social network	To visit friends and acquaintances

Note: respondents answer to what extent they agree with the proposition on a 5-point rating-format, ranging from 1 (almost never) to 5 (almost always)

with a good quality of life. The pre-operative quality of life was measured retrospectively by asking the patients to what extent the items of the questionnaire applied to them at a time point 3 months prior to their reconstructive surgery. To assess the most invalidating problems of excess skin, we asked for the patients' primary motivation to seek body contouring surgery, e.g. functional problems, aesthetical problems or complaints of dermatitis. Patients were asked for their satisfaction with the result of the reconstructive surgery and with the scar in particular. The satisfaction was documented on a scale ranging from 1 (very satisfied) to 4 (dissatisfied).

Data Collection

The records of all patients were reviewed retrospectively for demographic data and pre- and post-operative weight data.

Statistical Analyses

All statistical analyses were performed using SPSS for Windows version 12.0.1 (SPSS Inc, Chicago, IL, USA). Student's t test and multivariate analysis were used for parametric variables; nominal variables were analyzed with the Pearson chi-squared test. A two-sided p value of <0.05 was considered statistically significant.

RESULTS

Of the 61 patients who underwent reconstructive surgery, 43 patients (two males, 41 females) agreed to participate in the study, i.e. response rate of 70.5% (Table 2). The mean age of the patients was 41.5 years (range 23 to 60 years). The mean weight before the primary bariatric procedure was 138.2 kg (106–230) with a mean body mass index (BMI) of 48.2 kg/m^2 (35.8–79.5). Forty patients (93%) underwent laparoscopic gastric banding

TABLE 2
Patiënt characteristics

	number		***Mean (range)***
	n	***%***	
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			
• Laparoscopic adjustable banding	40	93,0	
• Gastric bypass (primary/secondary)	14 (3/11)	32.6 (7.0/25,6)	
Weight pre-bariatric surgery			138,2(106-230) / SD 23,7
BMI pre-bariatric surgery			48,2 (35,8-79,5) / SD 8,5
Weight pre-reconstructive surgery			86,9 (57,0-177,0) / SD 20,0
BMI pre-reconstructive surgery			30,7 (21,5-65,0) / SD 7,2
Interval between bariatric and reconstructive surgery in months			42,1^ (8-110) / SD 26,5

(LAGB); three 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 initial weight loss of 36.3% at a mean interval of 42.1 months (8–110) between their primary bariatric procedure and reconstructive surgery. This results in a mean weight of 86.9 kg (57.0–177) and a BMI of 30.7 kg/m^2 (21.5–65.0) at the time of reconstructive surgery.

TABLE 3
Reconstructive surgery procedures

Type of reconstructive procedure	***no. performed***	***% patients***
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 + breastreduction	2	2,9
Abdominoplasty + liposuction tights	1	1,5
Dermolipectomy legs + dogear correction	1	1,5
Total	**68**	**100**

A total of 68 reconstructive operations were performed in 43 patients (Table 3); 24 patients (55.8%) underwent one operation; 13 (30.2%) underwent two operations and six (14%) of the patients underwent three operations. Almost all (94%) operations were single reconstructive procedures. Most patients had an abdominoplasty (61%) or breast reduction/augmentation (25%).

Quality of Life

After reconstructive surgery, patients improved significantly on six of the seven psychosocial states of the Obesity Psychosocial State Questionnaire (Table 4; Fig. 1). The most significant improvement was seen in physical functioning and physical appearance. Reconstructive surgery improved physical functioning and patients felt healthier ($p<0.001$). Patients also experienced less depressive symptoms ($p<0.001$). Overall patients were more satisfied with their physical appearance and therefore had more self-confidence ($p<0.001$). In line with this, patients experienced less problems in intimacy and sexuality ($p<0.001$).v There was a significant difference in self-efficacy towards eating before and after reconstructive surgery ($p<0.001$); patients had more problems to cope with their eating behaviour after the operation. The improvement in quality of life was independent of the occurrence of complications and weight regain or loss. For 32 patients (74.4%), improvement in physical appearance was one of the most

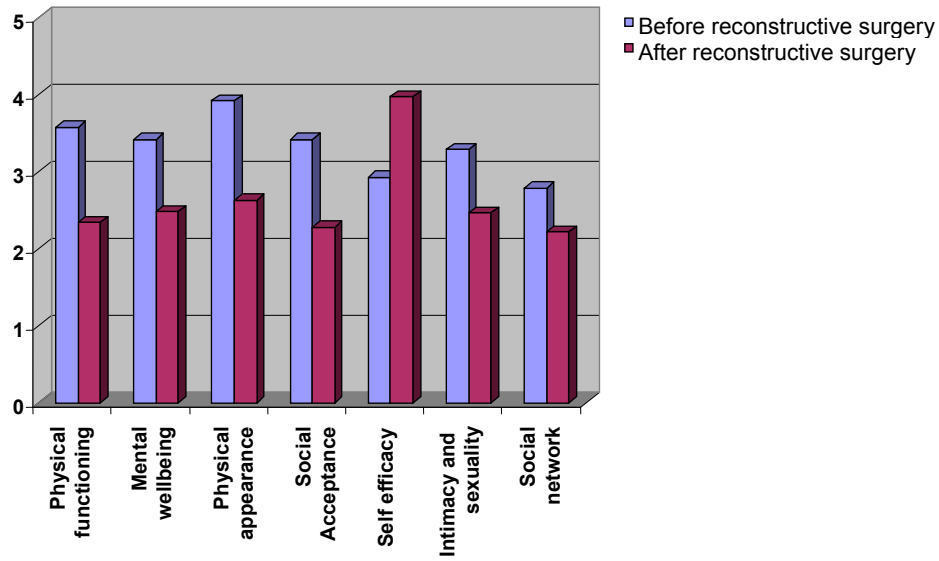

FIGURE 1
Quality of life for every psychological state before and after reconstructive surgery
Note: A lower score on a psychosocial state reflects less problems on that domain and corresponds with a good quality of life.

TABLE 4
Obesity Psychosocial State Questionnaire score before and after reconstructive surgery

Psychological states	***Before reconstructive surgery Mean (SD)****	***After reconstructive surgery Mean (SD)****	***p-value***
Physical functioning	3,58 (0,75)	2,34 (0,74)	<0,001
Mental well-being	3,42 (0,97)	2,48 (0,89)	<0,001
Physical appearance	3,92 (0,73)	2,63 (0,78)	<0,001
Social acceptance	3,42 (1,16)	2,28 (0,77)	<0,001
Self-efficacy toward eating	2,93 (1,4)	3,97 (0,74)	<0,001
Intimacy and sexuality	3,29 (1,13)	2,47 (1,02)	<0,001
Social network	2,79 (0,98)	2,22 (0,78)	<0,05

** score varied from 1 (almost never) to 5 (almost always)*

important motives to seek body contouring surgery. For eight patients (18.6%), this was the only reason. Another important motive was problems patients experienced in physical functioning. For 27 patients (62.8%), this was one of the reasons. Approximately 50% of the patients experienced problems with personal hygiene and complained of intertriginous dermatitis (51.2%).

Patient Satisfaction

Sixty-seven percent of the patients was satisfied with the overall result of the operation (Table 5, scores 1 and 2). Eight patients (18.6%) were dissatisfied (score 4). In the interview, we asked the patients to elucidate their dissatisfaction. Most patients were not satisfied with the proportions of their body after operation and with the occurrence of dog-ears in the scars in particular. Some patients had high expectations about the aesthetic result, based on examples from the internet, and were in the end disappointed with the result of their own operation.

TABLE 5
Patient satisfaction about reconstructive procedure

Satisfaction reconstructive surgery	***Score***	***No. of patients (%)***	***Cumulative %***
Result scar in specific	Very satisfied	15 (34,9)	34,9
	Satisfied	16 (37.2)	72,1
	Unsatisfied	6 (14,0)	86,0
	Very unsatisfied	6 (14,0)	100,0
Satisfaction overall	Very satisfied	9 (20,9)	20,9
	Satisfied	20 (46,5)	67,4
	Unsatisfied	6 (14,0)	81,4
	Very unsatisfied	8 (18.6)	100,0

Note: Satisfaction score : Very satisfied = 1, satisfied = 2, unsatisfied = 3, very unsatisfied = 4

Regression analysis was performed to determine factors influencing patient satisfaction. The occurrence of post-operative complications did not influence patient satisfaction (satisfaction score of 2.3 vs. 2.5). Weight increase after reconstructive 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.

DISCUSSION

This study of 43 post-weight-loss-surgery patients shows that reconstructive surgery leads to a significant improvement in quality of life. Irrespective of the occurrence of complications following the reconstructive procedures, the majority of patients was satisfied with the result of reconstructive surgery.

Morbid obesity is an increasingly common disease and its treatment is a challenge for many specialists. Weight loss surgery will lead to a long-lasting and significant weight loss and improvement in quality of life.[1-4] In the literature, studies on subsequent reconstructive surgery focus on the complications associated with the procedures. Our study is unique by reporting on a large cohort of patients with a long-term follow-up. The overall complication rate was 27.9%, which is in accordance to the literature (20–50%).[8-9] Despite the relative high percentage of complications, this was of no influence on patients' satisfaction. A total of 67% of the patients were satisfied to very satisfied with the final result of reconstructive surgery. The positive results of reconstructive surgery apparently justify the complication rate and the sequential operations often required. Patients who were dissatisfied complained about the dog-ears after abdominoplasty or the post-operative contour deformities which sometimes occur after reconstructive procedures. Massive weight loss results in an excess redundant skin creating new problems, both psychological and functional.[5-6] The loose hanging skin results in feelings of unattractiveness, embarrassment, limitations in activity, sexual problems and hygienic discomfort such as skin rash and infections.

Although some studies observe a stable long-term quality of life after bariatric surgery[10-11], patients are normally not well prepared to the sequelae of massive weight loss which may lead to a decline in quality of life and increase the risk of weight regain[12-13]. It has been suggested that these new problems affect the patients' quality of life to almost the same degree as the problems of overweight prior to the bariatric operation.[5-14] In our study, patients point out that this new problems do cause a poor quality of life but not in the same degree as before bariatric surgery.

In a previous study of Larsen et al., the quality of life before and after bariatric surgery was measured and compared with the general Dutch reference population.[15] Preoperative scores of patients on all dimensions of quality of life were significantly lower than scores of the age norm group. This difference diminished 1 year after the operation but increased again in the long-term on all dimensions. The exact cause of this decline is unclear, but one hypothesis might be that the functional and aesthetic deformity is a major factor of influence.

The role of reconstructive surgery following weight loss surgery is still underestimated by medical specialists. Currently, it is seen as a cosmetic adjunct to bariatric surgery. However, previous investigations have concluded that a positive effect on quality of life is also seen after other reconstructive procedures like reduction mammaplasty and cosmetic facial surgery.[16-17]

In our study, some 14% of the patients were scheduled for reconstructive surgery. This may be a conservative figure as some patients may have been operated outside our clinic. Most patients (93%) in our study underwent laparoscopic gastric banding as primary procedure. Compared to the gastric bypass procedure, the average weight loss following banding is substantially less. Therefore, in the bypass population, a higher percentage of patients may be in need of reconstructive surgery. The surgical treatment of obesity often fails due to failure to maintain the achieved weight. Reconstructive surgery may have an important role.[18] In previous studies analysing predictors of weight loss and control, it is suggested that quality of life is positively associated with long-term outcomes of weight management.[19-21] As reconstructive surgery results in an improvement in quality of life, it may contribute to the management of weight control.

In the interview, patients explicitly mention the great influence of high expectations. The expectations regarding the outcome of reconstructive surgery of most patients are based on examples and success stories on the internet, which often turn out not to be realistic. Patients are generally not prepared for the marked scarring following surgery. It is of great importance therefore to inform patients pre-operatively and outline realistic expectations.[5]

Our study has some limitations as it concerns a retrospective evaluation. Only patients who actually had undergone reconstructive surgery were included. In our study, we used the Obesity Psychosocial State Questionnaire, a self-developed questionnaire. The psychometric characteristics of the OPSQ were established in a previous study and, although not validated, proved to be satisfactory.[7] The pre-operative quality of life was measured retrospective, which may have given some bias to the results. In the future, prospective studies with obesity-related questionnaires should verify the current results.

CONCLUSION

The contribution of the reconstructive surgeon to the multidisciplinary treatment of morbid obesity is substantial and beneficial in the care for these patients. Dissatisfaction was mainly due to technical factors. As these are correctable factors, overall satisfaction could be improved. Reconstructive surgery should be included in the continuum of care and may improve the long-term weight outcome in the surgical treatment of morbid obesity.

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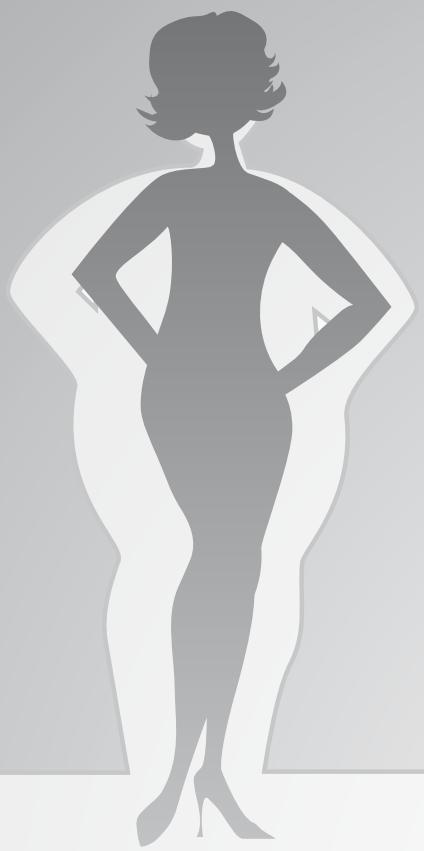

Chapter 6

Quality of Life Long-Term after Body Contouring Surgery following Bariatric Surgery: Sustained Improvement after 7 years

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ABSTRACT

Background

Bariatric surgery for morbid obesity results in massive weight loss and improvement of health and quality of life. A downside of the major weight loss is the excess of over-stretched skin, which may influence the patient's quality of life by causing functional and aesthetic problems. The purpose of the current study was to evaluate the patient's quality of life long-term after body contouring following bariatric surgery.

Methods

Quality of life was measured with the Obesity Psychosocial State Questionnaire in 33 post– bariatric surgery patients 7.2 years (range, 3.2 to 13.3 years) after body contouring surgery. Data were compared with previous assessments 4.1 years (range, 0.7 to 9.2 years) after body contouring surgery of the quality of life at that time and before body contouring surgery.

Results

Compared with appraisals of quality of life before body contouring surgery, a significant, mostly moderate to large, sustained improvement of quality of life was observed in post– bariatric surgery patients 7.2 years after body contouring surgery in six of the seven psychosocial domains. A small deterioration occurred between 4.1- and 7.2-year follow-up on two of the seven domains except for the domain efficacy toward eating, which showed a significant improvement. At 7-year follow-up, 18 patients (55 percent) were satisfied with the result of body contouring surgery.

Conclusions

This study indicates a sustained quality of life improvement in post–bariatric surgery patients after body contouring surgery. This suggests the importance of including reconstructive surgery as a component in the multidisciplinary approach in the surgical treatment of morbid obesity.

INTRODUCTION

Bariatric surgery is the only effective treatment of morbid obesity resulting in a long-term sustained weight loss, a decrease in co-morbidity and an improvement in the quality of life.[1-8] The skin overhang after massive weight loss causes feelings of unattractiveness and embarrassment and gives rise to hygienic and physical problems. These new problems have a negative impact on the quality of life of the post–bariatric surgery patient.[9]

More than two-thirds of the patients who have undergone bariatric surgery mention loose skin as a negative consequence of surgery.[3] Patient satisfaction with the result of bariatric surgery may decrease in the long term as a result of changes in physical appearance because of substantial weight loss.[3,10-11] Skin deformities after major weight loss may result in psychological problems (e.g., reduced mental well-being and satisfaction with physical appearance), social problems (e.g., reduced social acceptance, less intimacy, and a smaller social network), and physical problems (e.g., reduced physical functioning and skin problems).[3,9,12-14] After body contouring surgery, self-perceived physical appearance returned to values comparable to the normal population in patients who felt unattractive after bariatric surgery and the quality of life improved.[12,15-17] Body contouring surgery balances on the edge of functional and aesthetic surgery. It treats the adverse consequences of, for instance, burns, traffic accidents, or physical deformities after cancer treatment.[18] Physical, mental, and social quality of life have been indicated to improve after body contouring.[12,15,19] There is an ongoing debate of whether body contouring surgery is an optional or essential step after massive weight loss in the treatment of morbid obesity. Whereas bariatric surgery without body contouring has a beneficial influence on psychological functioning and quality of life,[3,10] a stabilization or even decline of this effect is seen from 2 years after surgery.[20] This could well be attributable to changes in physical appearance and the associated decline in satisfaction with one's body image. Body contouring surgery may therefore play a beneficial role in the long-term stabilization of the quality of life in patients with massive weight loss following bariatric surgery.

The aim of this study was to evaluate the quality of life at long-term follow-up after body contouring procedures following bariatric surgery.

METHODS

A total of 465 patients underwent bariatric surgery at the St. Antonius Hospital in Nieuwegein, the Netherlands, from November of 1995 to April of 2005. Of these patients, 61 (13 percent) had body contouring surgery in the same hospital following massive weight loss and were invited to participate in the study. On average 4 years later, in 2007,

43 patients reported their quality of life at a mean follow-up of 49 months after body contouring surgery and, retrospectively, their quality of life before body contouring.[4] Three years later, these patients were invited to participate again in the current study. If they gave informed consent, a questionnaire was sent.

Instruments

Quality of life was measured with the Obesity Psychosocial State Questionnaire (Table 1), an obesity-specific quality-of-life questionnaire.[8] For the purpose of this study, we used 31 items of the Obesity Psychosocial State Questionnaire, which measures seven domains (Table 1): physical functioning (six items), mental well-being (four items), physical appearance (11 items), social acceptance (three items), self-efficacy toward eating and weight control (one item), intimacy (four items), and social network (two items). Six of the seven scales have a moderate (Cronbach α between 0.50 and 0.80) to high (Cronbach α >0.80) reliability after modification, and one scale consisted of only one item.

The questionnaire has a rating scale ranging from 1 (almost never) to 5 (almost always). A lower score reflects few problems on the domain and thus a better quality of life. The psychometric characteristics of the Obesity Psychosocial State Questionnaire, established in a sample of 287 patients before and after (surgical or dietary) treatment for (severe) obesity, are satisfactory.[21]

TABLE 1
Example items of the Obesity Psychosocial State Questionnaire (OPSQ)

Psychosocial domain	***Example item***
Physical functioning	To kneel or to duck easily (reversed score)
Mental well-being	To feel depressed
Physical appearance	To feel fatty when someone takes a picture
Social acceptance	To be discriminated because of my weight
Self-efficacy	To feel helpless toward my eating behavior
Intimacy	To have sexual problems because of my weight
Social network	To visit friends and acquaintances (reversed score)

Note: respondents answer to what extent they agree with the proposition on a 5-point rating-format ranging from 1 (almost never) to 5 (almost always). A higher score reflects worse psychosocial well-being and functioning.

Miscellaneous Questions

Patients were asked to answer 12 additional questions about their weight, actual health status, whether they had or would undergo plastic surgery again, whether body contouring surgery was an inevitable step to improve daily quality of life, and satisfaction with the final result and with the scar on a scale from 1 (very satisfied) to 4 (dissatisfied).

To examine the association between weight status and quality of life, the patients were categorized into a group of patients with a stable weight or weight loss and a group of patients with weight gain after body contouring surgery and after 4 years' follow-up. A stable weight was defined as a weight with a maximum of plus or minus 3 kg in accordance to the weight measured at the time of reconstructive surgery and in 2007, on average 4 years after reconstructive surgery.

Statistical Analysis

All statistical analyses were performed using SPSS for Windows version 17.0 (SPSS, Inc., Chi-cago, Ill.). Paired *t* tests were used to compare the scores on the seven Obesity Psychosocial State Questionnaire domains before and after body contouring surgery, and short-term and long-term follow-up scores. These differences were expressed by way of Cohen effect sizes. Effect sizes of 0.2, 0.5, and 0.8 are considered to reflect differences of small, medium, and large magnitude, respectively.[22] Repeated measures analysis of variance with weight change as a covariate was used to examine whether quality-of-life changes between 4 and 7 years after body contouring surgery were explained by weight change. Chi-square tests and independent *t* test were used to examine possible determinants of satisfaction with body contouring surgery.

RESULTS

Forty-one patients were invited to participate again in this study. Two patients of the original sample could not be found because of change of address and phone number. Thirty-three patients (80 percent) returned the questionnaire, 32 women and one man, and were included in this study. The mean follow-up interval was 7.2 years (86 months; range, 38 to 159 months) since body contouring surgery and 11 years (132 months; range, 65 to 178 months) since bariatric surgery. Table 2 lists the characteristics of the patients.

Thirty-one patients (94 percent) underwent laparoscopic gastric banding and two patients underwent gastric bypass surgery as a primary procedure. Because of unsatisfactory results or band-related problems, eight of the 31 laparoscopic gastric banding patients underwent gastric bypass surgery as a reoperation. Four patients had diabetes at the time of body contouring surgery, and 21 patients had hypertension.

A total of 57 body contouring procedures were performed (Table 3). Sixteen patients (49 percent) underwent more than one procedure. No differences were seen in weight status and quality-of-life scores on the Obesity Psychosocial State Questionnaire between responders and non-responders at the time of our first study 4 years after body contouring ($p < 0.10$ for all).

TABLE 2
Characteristics of the 33 participants (22 women, 1 man)

Characteristics	***Mean***	***Range***
Age	50.4	34-65
Weight pre-bariatric surgery (kg)	135	106-170
BMI pre-bariatric surgery (kg/m^2)	47.8	35.8-66.5
Weight pre-reconstructive surgery (kg)	82	57-125
BMI pre-reconstructive surgery (kg/m^2)	29.6	21.5-50.2
Current weight (kg)	95	62-138
Current BMI (kg/m^2)	33.5	24.8-48.9

TABLE 3
Type and number of body contouring surgeries performed (57 procedures)

Type	***Number***
Abdominoplasty	30
Mammareduction	14
Dermolipectomy arms	1
Dermalipectomy legs	5
Liposuction legs	3
Liposuction thighs	1
Dogear correction	3

Since the previous study 3 years earlier, at a mean follow-up of 49 months (range, 8 to 110 months) after body contouring surgery, 15 patients (45 percent) regained weight and nine patients (27 percent) lost further weight. Eight patients (24 percent) had another body contouring surgery procedure after the previous study, 4 years after the first body contouring. Another 30 percent would have wanted another procedure but they did not choose it because their insurance company did not cover the procedure.

Quality of Life

As compared with their perception of the situation before body contouring surgery, at a mean follow-up of 7.2 years after body contouring surgery, patients significantly improved on six of the seven psychosocial domains of the Obesity Psychosocial State Questionnaire. Table 4 shows the effect sizes of the seven domains for the patients before body contouring surgery and at the 4-year and 7-year follow-up after body contouring surgery. At 4-year follow-up after body contouring surgery, patients perceived a large improvement of quality of life (d>0.80) in the domains physical functioning (t = 5.95, p = 0.000), mental wellbeing (t = 5.09, p = 0.000), physical appearance (t = 7.71, p = 0.000), and social acceptance (t = 5.63, p = 0.000). For intimacy, a medium difference was seen (t = 4.29, p = 0.000); for social network, a small difference was seen (t = 2.29, p = 0.029). A large deterioration was seen for self-efficacy at 4-year follow-up (t = –4.46, p = 0.000).

TABLE 4
Mean scores (± SD) of 33 patients on seven domains of the Obesity Psychosocial State Questionnaire before (1) and short-term (2) and long-term (3) after body contouring surgery

Psychosocial Domain	***1. Pre-body contouring surgery***	***2. Post-body contouring surgery; 4-years follow-up***	***3. Post-body contouring surgery; 7-years follow-up***	***d (1-2)***	***d (1-3)***	d (2-3)
Physical functioning	3.48 ± 0.82	2.38 ± 0.76	2.72 ± 0.96	1.40 ***	0.84 ***	-0.39 *
Mental well-being	3.34 ± 0.93	2.52 ± 0.91	2.77 ± 1.07	0.91 ***	0.57 **	-0.26 ns
Physical appearance	3.95 ± 0.66	2.73 ± 0.76	3.12 ± 0.91	1.71 ***	1.03 ***	-0.47 *
Social acceptance	3.29 ± 1.25	2.23 ± 0.61	2.21 ± 0.85	0.93 ***	0.99 ***	0.03 ns
Self-efficacy	2.92 ± 1.41	3.95 ± 0.75	3.27 ± 1.04	-0.86 ***	-0.28 ns	0.74 **
Intimacy	3.17 ± 1.27	2.46 ± 1.06	2.64 ± 1.04	0.59 ***	0.45 *	-0.17 ns
Social network	2.70 ± 0.91	2.31 ± 0.83	2.33 ± 0.92	0.45 *	0.41 *	-0.02 ns

Note. A higher score on the Obesity Psychosocial State Questionnaire reflects a worse psychosocial state
** p<0.05, ** p<0.01, *** p<0.001, ns not significant (paired t-tests); d = Cohen's effect*

At 7-year follow-up, a large improvement as compared with the appraisal of the situation before body contouring surgery was seen in the domains physical functioning (t = 4.47, $p < 0.001$), physical appearance (t = 4.50, $p < 0.001$), and social acceptance (t = 4.61, $p < 0.001$). For mental well-being, a medium difference was seen (t = 3.55, p = 0.001). A small difference was seen for intimacy (t = 2.25, p = 0.03), self-efficacy (t = –1.29, p = 0.21), and social network (t = 2.64, p = 0.013).

Between 4-year follow-up and 7-year follow-up, a medium improvement was seen for the domain self-efficacy (t = 3.40, p = 0.002). This improvement was independent of weight change; that is, the difference between the two follow-up measurements of self-efficacy remained significant after controlling for weight change (F = 6.30, p = 0.02). A small deterioration was seen in the domains physical functioning (t = –2.16, p = 0.04), mental well-being (t = –1.48, p = 0.15), and physical appearance (t = –2.27, p = 0.03). This deterioration was no longer significant after correction for weight change: physical functioning (F = 0.22, p = 0.65), mental well-being (F = 0.59, p = 0.45), and physical appearance (F = 0.56, p = 0.46). This reflects that weight regain explained the deterioration in these quality-of-life domains. For social acceptance (t = 0.14, p = 0.89), intimacy (t = –0.80, p = 0.43), and social network (t = –0.09, p = 0.93), trivial differences were seen between 4-year and 7-year follow-up.

Weight Status and Quality of Life

Table 5 shows the results of the Obesity Psychosocial State Questionnaire for patients with a stable weight or weight loss after body-contouring surgery and patients with weight regain. At 7-year follow-up, as compared with patients with a stable weight or with weight loss, a significantly worse score was seen in patients who had gained weight

TABLE 5
Mean scores on seven domains of the Obesity Psychosocial State Questionnaire for 18 patients with weight loss or a stable weight and 15 patients with weight regain at 7-year follow-up after body contouring surgery

Psychosocial domain	***Stable weight or weight loss after body contouring surgery***	***Weight regain after body contouring surgery***	***p-value (2-tailed)***
Physical functioning	2.48 (0.94)	2.95 (0.96)	ns
Mental well-being	2.27 (0.93)	3.22 (1.00)	<0.01
Physical appearance	2.78 (0.82)	3.36 (0.93)	ns
Social acceptance	1.82 (0.60)	2.41 (0.95)	<0.05
Self-efficacy	3.75 (0.77)	2.82 (1.07)	<0.01
Intimacy	2.30 (0.98)	3.13 (1.303)	<0.05
Social network	2.09 (0.74)	2.59 (1.02)	ns

since body contouring on the domains mental well-being ($p = 0.009$), social acceptance ($p = 0.047$), self-efficacy ($p = 0.008$), and intimacy ($p = 0.03$). On the domains physical functioning, physical appearance, and social network, patients with weight regain had worse scores, but the differences were not significant ($p > 0.05$).

Patient Satisfaction

At 7-year follow-up after body contouring surgery 18 patients (55 percent) were (very) satisfied with the result of body contouring surgery, four patients (12 percent) had a neutral opinion, and 11 patients (33 percent) were not satisfied with the result. At 4-year follow-up, 29 patients (67 percent) were (very) satisfied, six patients (14 percent) had a neutral opinion, and eight patients (19 percent) were not satisfied with the result. All but one patient (97 percent) would undergo body contouring surgery again and considered body contouring surgery after massive weight loss an inevitable step to improve daily quality of life. Neither body mass index ($t = 0.02$, $p = 0.99$) or weight change before body contouring ($t = 0.81$, $p = 0.43$) nor weight change after body contouring surgery ($t = 0.05$, $p = 0.97$) or between 4-year follow-up and 7-year follow-up ($t = –0.25$, $p = 0.81$) differed between patients who were satisfied and patients who were not satisfied with body contouring surgery. Satisfaction did also not differ for patients who underwent laparoscopic gastric banding or gastric bypass surgery (chi-square = 0.48, $p = 0.67$). Finally, satisfaction did not differ between patients who did or did not have abdominoplasty (chi-square = 1.24, $p = 0.42$), patients who did or did not have reduction mammaplasty (chi-square = 2.20, $p = 0.27$), or patients who did or did not have other types of body contouring surgery.

DISCUSSION

In this study of 33 post-bariatric surgery patients, with a mean follow-up of more than 7 years after body contouring surgery, a trivial to small decrease in quality of life was seen from 4 to 7 years after reconstructive surgery. However, patient quality of life was still significantly better on six of the seven quality-of-life domains than the perception of quality of life before body contouring.

Enhancement of psychosocial functioning is an important goal of bariatric surgery. Body image dissatisfaction is a frequent phenomenon in obesity and is correlated to low quality of life.[23] An improvement of quality of life and body image after bariatric surgery is widely proven.[24] However, a decline may occur after the first post-operative years.[24,25] Some bariatric patients report body image dissatisfaction caused by the loose, hanging skin after massive weight loss.[9] For these patients, body contouring surgery could be a means of improving quality of life. The results of the current study with long-term evaluations suggest that body contouring surgery causes a sustained improvement of quality of life.

Our study showed that quality of life deteriorated somewhat with increasing time after body contouring surgery. This could reflect that patients get used to the improvement after resection of skin surplus. Directly after body contouring surgery, patients likely experience benefit because of a reduction of physical and hygienic problems.[27] Perhaps after a number of years, patients are more realistic or critical of these results and focus more on the aesthetic result. Most patients have high expectations about the aesthetic results of body contouring surgery. The reality after corrective surgery can be disappointing.[13] Surgery to one part of the body can lead to an imbalance of body contours and sometimes results in extensive scars. This implies that it is important to offer realistic and extensive preoperative information about both the possibilities and limits of body contouring surgery to prevent unrealistic expectations and disappointment.

Another explanation for deterioration of quality of life could be weight regain. Obesity, negative body image, and quality of life are inextricably linked.[28] In the current study, 20 of the 33 patients had weight regain (mean, 13.2 kg) between 2007 and 2010. Our analysis showed that weight regain explained most of the deterioration of quality of life long term after body contouring surgery.

Even though not all patients were satisfied with the result, all but one patient would choose to undergo body contouring surgery again, in accordance with the literature.[27,29] Patients reported that body contouring surgery was an inevitable step in the process of losing weight by bariatric surgery. Several possible determinants of satisfaction with body contouring surgery were examined, but body mass index, weight change before and after body contouring surgery, the occurrence of complications, type of bariatric surgery, and type of body contouring surgery were not associated with satisfaction.

Body contouring after bariatric surgery may also result in improvement of functional outcomes and an increase in physical activity as has been observed after reduction mammaplasty.[27,30] Physical activity after bariatric surgery is associated with sustained weight loss and improved quality of life.[31] Thus, body contouring surgery may have several additional benefits in the treatment of morbid obesity.

Our study is unique by analyzing a relatively large cohort of post–bariatric surgery patients long term after body contouring surgery. As yet, no study followed patients for more than 2 years after body contouring.[9,15] This study also has some limitations. Retrospective appraisals of how patients perceived their quality of life before body contouring surgery were used. Furthermore, the psychometric characteristics of the Obesity Psychosocial State Questionnaire were only established preliminarily[8] but were found to be satisfactory.

Finally, this study had an observational design in which only patients who had body contouring surgery were included. We had no control group. To be able to conclude that changes in quality of life are caused by body contouring (in-stead of being attributable to time or aging effects), an experimental design should be used including patients who nave not undergone body contouring surgery after massive weight loss.

CONCLUSIONS

A trivial to small decrease in quality of life was seen from 4 to 7 years after body contouring surgery, which could be mostly explained by weight regain. Quality of life in post–bariatric surgery patients at a mean follow-up of 7 years after body contouring surgery is significantly improved compared with their appraisal of preoperative quality of life. This suggests that it is worthwhile to include a plastic surgeon in the multidisciplinary treatment of morbid obesity.

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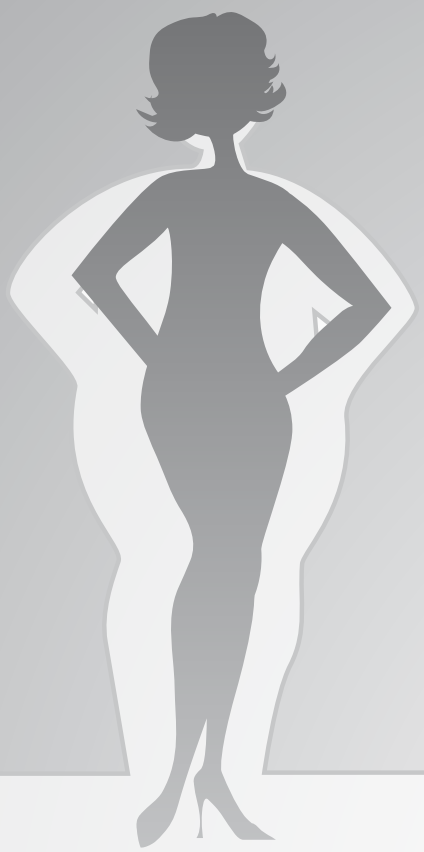
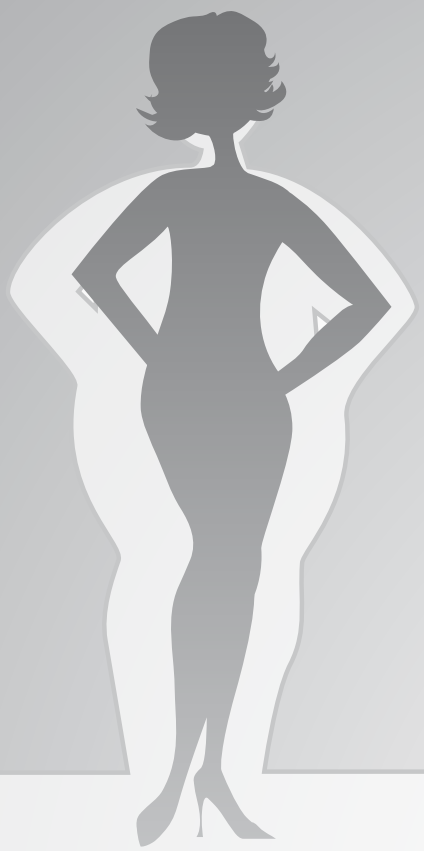


Part III

Complications



Chapter 7

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

Obesity Facts 2011; 4: 61-66

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ABSTRACT

Background

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/mammapexy (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 preoperative 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 but also comes along with unsightly excessive and lax skin.[1] Following bariatric procedures an increasing number of patients is seeking body contouring surgery. Although these operations are associated with in 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.

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).

TABLE 1
Clavien Classification of surgical complications

Grade	***Definition***
Grade I	Any deviation from the normal post-operative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions. *
Grade II	Requiring pharmacological treatment with drugs other than such allowed for Grade I complications. (bloodtransfusions and total parenteral nutrition are also included)
Grade III	Requiring surgical, endoscopic or radiological intervention
Grade IIIa	Intervention not under general anaesthesia.
Grade IIIb	Intervention under general anaesthesia.
Grade IV	Life-threatening complication (requiring IC/ICU management)
Grade IVa	Single organ dysfunction.
Grade IVb	Multiorgan dysfunction
Grade V	Death of a patient

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

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). Eighteen patients

TABLE 2
Patient characteristics

Patient characteristics	***Number 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			
• Laparoscopic adjustable banding	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%	

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). Forty 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/m^2 (21.5–65.0 kg/m^2) 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

TABLE 3
Type of body contouring surgery

Body-contouring procedure	*Total amount performed*	*% patients underwent 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 + breastreduction	2	2,9
Abdominoplasty + liposuction tights	1	1,5
Dermolipectomy legs + dogear correction	1	1,5
Total	**68**	**100**

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/mammapexy (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 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/m^2; $p < 0.005$, 95% CI 0.2–9.3 kg/m^2) . 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/m^2), overweight (25–29.9 kg/m^2), obese (30.0–39.9 kg/m^2) and morbidly obese (>40 kg/m^2) (fig. 1). There was a linear relationship between weight status and complication

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%)

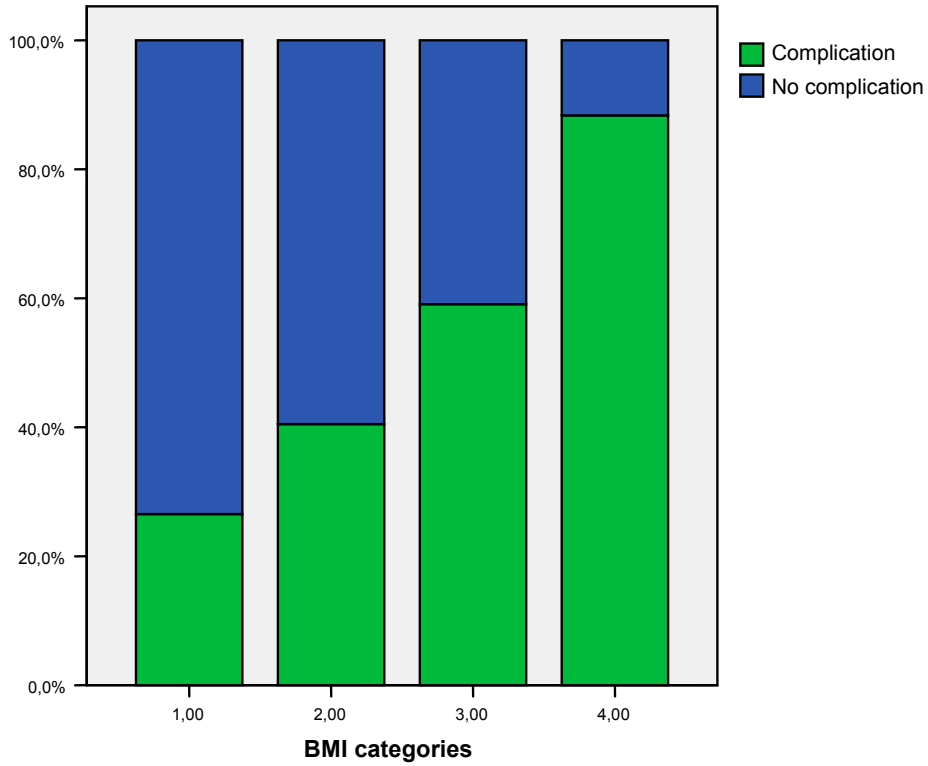

FIGURE 1
Percentage of complications per BMI category

rate. Obese (BMI > 30 kg/m^2) patients had a significantly increased complication rate when compared to non-obese (BMI < 30 kg/m^2) 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 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/m^2) and non-obese (BMI < 30 kg/m^2). 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

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)	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

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.

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] 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/m^2 experienced significant less complications than patients with a BMI >30 kg/m^2 (19.5

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.[8]	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

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. and Neaman.[4,12]

The most interesting secondary finding of our study was the influence of a stable weight prior to surgery. Patients having a stable weight plateau for 3 months or longer before body contouring surgery experience significant less complications in comparison to patients with a preoperative 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 ≥30% and long plateau phase of 12 months, de Kerviler at 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 preoperative planning and patient selection are essential to optimize the results of body contouring surgery in post-bariatric patients.

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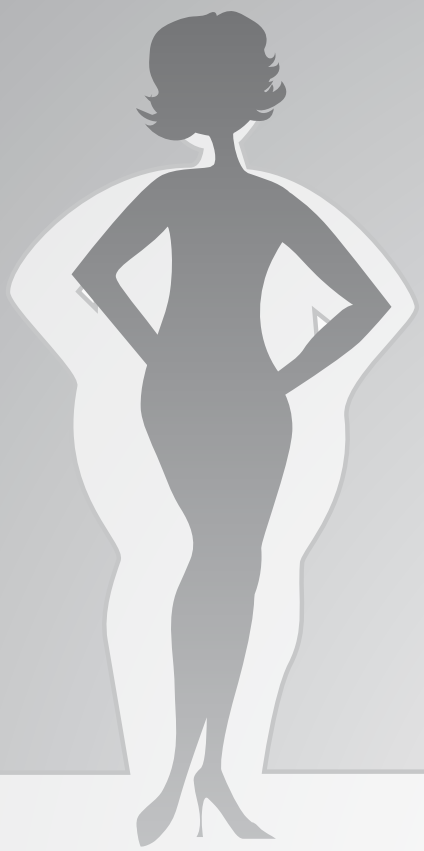

Chapter 8

Complications After Body Contouring Surgery in Post-Gastric Bypass Patients: The Role of Nutritional Deficiencies

Based on a Dutch paper published in Nederlands Tijdschrift voor Plastische Chirurgie, 111-116, 2014

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ABSTRACT

Background

Gastric bypass is the most frequently performed bariatric procedure today in the Netherlands and as a consequence there will be an increase in post-gastric bypass patients searching for body contouring surgery. Body contouring surgery is associated with a high complication risk of 25%-67% and many risk factors are described. Nutritional deficiencies frequently seen after gastric bypass surgery may also play a role in the development of complications. The purpose of this study is to evaluate wound-related complications after body contouring surgery in post-gastric bypass patients. The prevalence of preoperative nutritional deficiencies in this population was analyzed.

Methods

A total of 52 post-gastric bypass patients were reviewed retrospectively for demographic data, weight status, nutritional deficiencies pre-operative to body contouring surgery and post-operative complications. Wound-related complications were categorized in wound dehiscence, wound infection, (infected) hematoma, abscess, seroma and hematoma. Complications were further classified according to the Clavien classification system.

Results

A total of 68 body contouring procedures were performed and most commonly performed procedures were abdominoplasty (n=32; 47.1%) and breast reduction/mammapexy (n=19; 27.9%). The overall wound-related complication risk was 39.7%. In 26.9% of the patients with a complicated body contouring procedure one or more preoperative nutritional deficiencies were found, despite the use of vitamin supplementation. In the group of patients with preoperative deficiencies, more post-operative complications occurred.

Conclusion

The complication rate following body contouring surgery in post-gastric bypass patients is high. One hypothesis is that the high prevalence of nutritional deficiencies in this particular patient population might be responsible for this. In line with this, evaluation and optimization of nutritional status in post-gastric bypass patients before body contouring surgery is advisable.

INTRODUCTION

In the next few years there will be an increase of post-bariatric patients searching for body-contouring surgery. Body contouring surgery has a high complication risk of 25-67%.[1-9]

Post-bariatric patients have a higher complication risk compared to non-bariatric patients. In a recent meta-analysis the complication risk increased with 60%.[10-12] Most of these complications are wound healing disorders ranging from superficial infection to extensive necrosis. To optimize the treatment of this particular patient population we should define the risk factors in order to lower the complication rate. Smoking, diabetes mellitus, high body mass index (BMI) and unstable weight are well-known risk factors for the development of complications.[3,4,8-10,13,14] The presence of nutritional deficiencies after bariatric surgery may also play an important role in the development of complications. Nutritional deficiencies are a well-known and frequent seen complication after gastric bypass surgery. These deficiencies can develop soon after surgery, but even on the long term and will occur despite standard supplementation.

The purpose of this study is to evaluate wound- related complications after body contouring surgery in post-gastric bypass patients. The prevalence of preoperative nutritional deficiencies in this population was analyzed.

METHODS

Patients

All patients who underwent gastric bypass surgery at the St Antonius Hospital in Nieuwegein during the period January 2009 to December 2011 were included, provided that they were in the follow-up program. Electronic patient records were reviewed retrospectively. Data till June 2013 were analyzed. Patients were included when they underwent body contouring surgery in the same clinic after gastric bypass surgery.

Treatment

According to the protocol of the Bariatric Surgery department all post-gastric bypass patients received standard vitamin supplementation including Calci Chew D3 (calcium carbonaat/colecalciferol) 1000 mg/800EI once daily and multivitamin with 100% iron twice daily. Blood samples to evaluate nutritional status were also part of post-gastric bypass protocol. The following nutrients were analyzed: hemoglobin, calcium, phosphate, albumin, iron, ferritin, transferrin, vitamin B1, vitamin B6, vitamin B12, vitamin D3, folic acid and parathyroid hormone. Patients were referred to the Department of Plastic and Reconstructive Surgery if they had complaints of redundant skin and their

weight had stabilized. The plastic surgeon determined the type of surgery and timing of the operation.

Outcome

The following data and variables were collected: age, gender, BMI and weight before gastric bypass surgery, BMI and weight before body contouring surgery, weight stability, nutritional status pre-body contouring surgery, weight of resected tissue, smoking habit, diabetes mellitus, type of body contouring surgery and type and degree of complications. Percentage of excess weight loss was calculated for all patients.

Every deviation of the normal post-operative course was defined as a post-operative complication. Wound-related complications were categorized in wound dehiscence, wound infection, (infected) hematoma, abscess, seroma and hematoma. Complications were further classified according to the Clavien classification system, which is a therapy-oriented grading system based on the severity of the complication.[45]

Most recent laboratory values regarding nutritional status before body contouring surgery were used for analysis. The results of the nutrients most important for wound healing were collected for analysis: hemoglobin, albumin, ferritin, iron, vitamin B1, vitamin B6, vitamin B12, vitamin D3 and folic acid. A low ferritin was defined as iron deficiency.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences, version 20.0 (SPSS, Chicago, IL). To assess if there were any significant differences between the group with and the one without complications, we used the unpaired t-tests and Fishers exact test.

RESULTS

Study population

A total 111 of 588 post-gastric bypass patients were referred to the department of Plastic and Reconstructive surgery. Fifty-two patients were operated at the time of data collection and they were included in the study (table 1). Other patients were advised to lose more weight to be eligible for body contouring surgery (n=5) or were not operated because reimbursement had not been obtained (n=35). In four patients the first visit was planned and 14 patients were awaiting approval for reimbursement by the insurance company. The mean age was 49 year (range 30-65 year), and 80.8% (n=42) of the population was female. The mean interval between bariatric surgery and body contouring surgery was 24 months (range 11-46).

TABLE 1
Patient characteristics

	Mean	***Percentage (N)***
Age (years)	49 (±7.9)	
Female		80.8% (n=42)
Pre-bariatric surgery BMI, kg/m^2	45.2 (± 3.4)	
Pre-body contouring surgery BMI, kg/m^2	28.3 (± 3.6)	
Stable weight, months	7.9 (± 4.5)	
Excess Weight Loss, %	74 (±15)	
Type of body contouring		
• Abdominoplasty		47.1% (n=32)
• Breast reduction/mammapexy		27.9% (n=19)
• Scar correction / resection		11.8% (n=8)
• Thighpalsty		8.8% (n=6)
• Brachioplasty		4.4% (n=3)

Mean body mass index prior to gastric bypass surgery was 45.2kg/m^2 (range 38.1-54.3kg/m^2). Prior to body contouring surgery patients had a mean excess weight loss of 74% resulting in a mean BMI of 28.3kg/m^2 (range 20.8-38.6kg/m^2).

Body contouring procedures

A total of 68 body contouring procedures were performed. Forty patients were operated once, nine patients were operated twice and three patients were operated three times. Most common procedures were abdominoplasty (n=32; 47.1%) and breast reduction/mammapexy (n=19; 27.9%) (table 1). In one patient with a history of breast cancer a Deep Inferior Epigastric Perforator flap was performed.

Post-operative complications

The overall complication rate was 41,2% (28 procedures). In 27 of these 68 procedures it concerned a wound-related complication (39.7%) (table 2). The most common wound-related complication was a wound infection (n=10; 14.7%). According to the Clavien classification eight grade I complications, 12 grade II complications and seven grade III complications were seen. In six cases a reoperation was performed because of a hematoma. One procedure was complicated because of a severe infection and the formation of an abscess requiring reoperation. No grade IV or V complications occurred.

There were no significant differences in baseline characteristics between the group of patients with a complication and the group of patients without a complication (table 3). In one patient the body contouring procedure was complicated by an acute coronary

TABLE 2
Post-operative wound-related complications according to the Clavien–classification

Grade	***Number (%)***
Graad I (no need for pharmacological treatment or surgical and radiological interventions)	8 (11.8%)
Graad II (pharmacological treatment)	12 (17.6%)
Graad III (surgical or radiological intervention)	7 (10.3%)
Graad IV (life-threatening complication (requiring IC/ICU management)	1 (1.4%)
Graad VI (death of a patient)	0

TABLE 3
Patients with and without a post-operative complication

	No complication (n=41)	***Complication (n=27)***	***Significance***
Age, year*	51 (±9)	49(±7)	*ns*
Female **	35 (85%)	19 (70%)	*ns*
Smokers **	6 (15%)	5 (19%)	*ns*
Diabetes mellitus **	3 (7%)	3 (11%)	*ns*
Pre-bariatric surgery BMI, kg/m^2 *	46.3 (±4.7)	44.7 (±4.0)	*ns*
Pre-body contouring surgery BMI, kg/m^2 *	28.2 (±3.6)	28.5 (±3.5)	*ns*
% Excess weight loss, percentage*	75 (±13)	71 (17)	*ns*
ASA classification ***	2	2	*ns*
Stable weight, months *	8.0 (±4.8)	7.8 (±4.2)	*ns*
Weight resected tissue, gram *	1612 (±1789)	2041 (1529)	*ns*
Number of patients with nutritional deficiency **	8 (20%)	10 (37%)	*ns*

** mean (SD); ** percentage (number); *** mean*

syndrome with impending respiratory distress, which required referral to the intensive care unit. There was no evidence of permanent injury.

Nutritional status

In 67 cases laboratory results were available regarding nutritional status before body contouring. Mean time between laboratory control and body contouring surgery was 6 months (range 0 – 20 months). Eighteen patients (26.9%) were diagnosed with a preoperative deficiency of at least one nutrient. Most common deficiencies were of vitamin B12 (10%, n=7) and iron (7%, n=5) (table 4). None of the patients were deficient in albumin. In 25 patients laboratory control took place in the period 3 months prior to surgery (table 4). Also in this group the most common deficiencies were of vitamin B12 and iron, both in 12% (n=3) of the patients. In 10 of the 27 patients (37%) with a complicated body contouring procedure one or more preoperative deficiencies were found. In the group of patients without a complication, eight of 41 patients (20%) had a preoperative nutrition deficiency (table 3).

TABLE 4
Prevalence of nutritional deficiencies in all patients (67) and in patients with laboratory test within 3 months of prior to body contouring surgery (25)

	Within 20 months prior to surgery n=67	***Within 3 months prior to surgery n=25***
Vitamin B1 deficiency	0	0
Vitamin B6 deficiency	4% (n=3)	8% (n=2)
Vitamin B12 deficiency	10% (n=7)	12% (n=3)
Folic acid deficiency	3% (n=2)	0
Iron deficiency *	7% (n=5)	12% (n=3)
Albumin deficiency	0	0
Anaemia	4% (n=3)	8% (n=2)

**Defined a low ferritin*

DISCUSSION

In this evaluation of gastric-bypass patients who underwent body contouring surgery an overall wound-related complication risk of 39.7% was found. In 26.9% of the patients with a complicated body contouring procedure one or more preoperative nutritional deficiencies were found, despite the use of vitamin supplementation. In the group of patients with preoperative deficiencies, more post-operative complications occurred.

Our results showed a high overall complication risk, which is similar to that reported in literature (25-67%).[1-9] Post-bariatric patients do have a higher complication rate following body contouring surgery compared to non-bariatric patients.[10-12] More specific, the percentage of wound-related complications is high and different from more general post-operative complications. Many risk factors for complications are described in literature: like BMI, smoking, diabetes mellitus, percentage of excess weight loss (%EWL) and a stable weight prior to surgery.[3,4,7-9,13,26] In recent years, the influence of nutritional deficiencies on wound related complications in post-bariatric patients has been the subject of an increasing number of reports.[11,16-17]

Nutritional deficiencies are a common complication following bariatric surgery. Therefore, all post-bariatric patients are prescribed oral vitamin supplementation.[18] New deficiencies can occur even 10 years after surgery despite standard supplementation.[19] Deficiencies of albumin, iron, vitamin B12 and vitamin D are frequently described after gastric bypass surgery.[16-18,22,24,27] Vitamin A, vitamin C, zinc and selenium are less common.[16-19,22,24,28-29] The risk of nutritional deficiencies is higher after gastric bypass surgery through malabsorption, less intrinsic factor and intake restriction, compared to laparo-

scopic gastric banding in which the bioavailability of nutrients is not disturbed.[18,30-31] This might explain the high complication risk in the current study in contrast to our first study in which mostly laparoscopic gastric banding patients were included.[4] Nowadays, laparoscopic gastric banding is less popular and the gastric bypass procedure is one of the most performed bariatric procedures. In this light, it is important to be aware of these possible deficiencies when body contouring surgery is planned.

Patients with nutritional deficiencies may have delayed wound healing as well as an increased risk for wound infection.[11,17,32-39] Protein, vitamin A, vitamin C, vitamin E, iron, zinc and copper are particularly important for wound healing.[17,32,39-42] The advice is to correct nutritional deficiencies as part of wound care.[39-42] In many other medical specialties, like the care for decubitus and burn patients, evaluation and optimization of nutritional status is seen as an essential part of good (wound care) treatment.[36-38] Nutritional status is evaluated by a combination of blood samples and a thorough inventory of intake and weight loss or regain.

Now we are aware of the importance of a good nutritional status for wound healing, we might use this knowledge for the care of gastric bypass patients who are indicated for body- contouring surgery. Body contouring procedures can be extensive and prolonged and are associated with a high complication rate. Wound healing problems are especially frequent. Nutrients important for wound healing are frequently deficient after gastric bypass surgery. One hypothesis might be that these deficiencies are (in part) responsible for the high complication rate in post-bariatric body contouring surgery. Prospective studies focusing on the causal relationship between preoperative deficiencies and the occurrence of post-operative complications in post-bariatric body contouring surgery are lacking so far.

This is the first study in the Netherlands focusing on complications following body contouring surgery in post-bariatric patients in which nutritional deficiencies were evaluated. The shortcoming of this article is the retrospective character, which results in missing data. At our department of Plastic and Reconstructive Surgery, laboratory testing was no standard preoperative care in post-bariatric patients. The interval between the latest blood sample and body contouring surgery was therefore variable and no causative relationship could be drawn between nutritional deficiencies and post-operative complications.

In accordance with this study and recent literature about the role of nutritional deficiencies in wound healing it seems reasonable to evaluate nutritional status in post-gastric bypass patients who are candidates for body contouring surgery. Laboratory control may focus on frequently described deficiencies like vitamin A, vitamin B, vitamin C, vitamin

E, folic acid, iron, zinc, copper and protein.[11,32,39,42-44] Furthermore, a thorough inventory of intake and weight status by a dietician with special interest in (post) bariatric patients is advisable. In particular, knowledge of protein intake is important because the (pre) albumine content in blood is unreliable for the actual protein status.[31] We advice evaluation and optimization of nutritional status preoperative to body contouring surgery, as this may contribute to a lower complication risk.

CONCLUSION

The complication rate following body contouring surgery in post-gastric bypass patients is high. The high prevalence of nutritional deficiencies in this particular patient population might be responsible for this. We argue to evaluate and optimize nutritional status in post-gastric bypass patients before body contouring surgery. It might be considered to refer patients to a bariatric multidisciplinary team of specialized dietician for this purpose.

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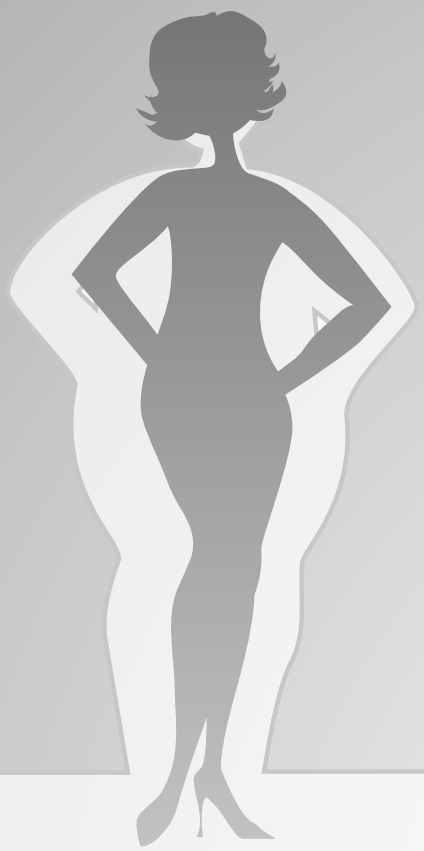

Chapter 9

General Discussion and Future Perspectives

GENERAL DISCUSSION

The dramatic increase of bariatric surgery in the last decade has led to a new field in plastic surgery: Post-bariatric body contouring surgery. When we started our research in 2007 little was known about this new subspecialty. In the first ten years since the introduction of bariatric surgery in the St. Antonius Hospital in 1995 less than 500 bariatric procedures were performed in total and only 61 patients underwent post-bariatric body contouring surgery in our clinic. Today, more than 850 bariatric procedures are performed yearly with laparoscopic gastric bypass as the most frequently performed procedure. As a consequence the demand for post-bariatric body contouring surgery has risen as well. Subject of this thesis is the optimal treatment of these unique and complex patients which requires a better understanding of the risks and benefits of body contouring surgery.

The main conclusions of the studies presented in this thesis are as follows:

- Body contouring surgery is associated with high complication rates, especially after gastric bypass procedures.
- A stable weight over a period of at least 3 months prior to body contouring surgery and a BMI<30 are associated with a significant lower complication rate.
- Nutritional deficiencies will occur after gastric bypass surgery despite supplementation and the effect of oral supplementation as treatment is limited.
- Long-term improvement in quality of life is seen after body contouring surgery in massive weight loss patients.
- There is a contradiction between patients' indicated motives for body contouring surgery (i.e. physical and hygienic skin problems) and their expectations of the post-operative outcome (i.e. changes in psychological status and social relations). The main reason for patients not to undergo body contouring surgery are the significant costs of the surgery.
- The Pittsburgh Rating Scale could not be validated as a reliable classification system for skin deformities after massive weight loss.

In this discussion two key issues of body contouring surgery will be discussed, i.e. the goals of body contouring surgery and the selection of patients for this kind of surgery.

Goals of post-bariatric body contouring surgery

The role of body contouring surgery in the treatment of morbid obesity is unclear. Is it only a cosmetic adjunct to bariatric surgery or does it really contribute in a positive way to the treatment of morbid obesity in the long term? The treatment goals of bariatric surgery are a sustained massive weight loss, a decrease of co-morbidities and an

improvement in quality of life. When body contouring surgery is seen as a continuity of care for morbid obese patients, the goals should be similar to that of bariatric surgery. Most weight loss following bariatric surgery is achieved in the first post-operative year, while a plateau is reached at 18-24 months after surgery. As many as 50% of the patients may regain some weight over the years.[1] One hypothesis for this relapse might be the discontent of patients with loose hanging skin and the associated complaints. This might result in less motivation for healthy eating patterns. Recently, a study of Balagué showed better long-term weight control in gastric bypass patients receiving body contouring compared to patients without additional body contouring.[2] This is the first prospective study showing the impact of body contouring surgery on long term weight control after gastric bypass surgery. These encouraging results must be objectified in future studies.

The other main goal of bariatric surgery is improvement in the quality of life. In recent years improvement in quality of life has been reported after body contouring surgery in massive weight loss patients.[3-5] This is also supported in chapter 5 and 6 of this thesis, although we must cautiously interpret our results due to the retrospective method of the quality of life assessment before body contouring surgery. Modaressi et al. showed in a prospective study a significant improvement in health related quality of life (HRQoL) after body contouring surgery in gastric bypass patients compared to their preoperative HRQoL and also compared to gastric bypass patients who never had body contouring.[6] Body image also seems to improve after body contouring surgery.[3,7]

We propose to define long-term weight loss and improvement in quality of life as main goals of body contouring surgery, as a continuity from bariatric surgery. If it can be proven that these two goals can be achieved in massive weight loss patients with body contouring surgery, then body contouring surgery has additional value in the treatment of morbid obesity. Within this perspective, it seems justified to define body contouring as part of the treatment of morbid obesity.

Selection

The second question which needs to be answered is; What is the best way to select patients for body contouring surgery? Objective parameters and clear selection criteria as used for patient selection in bariatric surgery are lacking for body contouring surgery so far. There are many functional and psychological factors influencing patients desire for body contouring (chapter 4). Patients do report a broad range of physical and psychosocial problems as a result of the excess skin. The degree of excess skin will influence the type and severity of complaints. Al-Hadithy et al showed a significant quantifiable correlation among the degree of ptosis and psychological morbidity.[8] In our opinion all patients who have complaints caused by excess skin do have an indication for treatment, including surgery. Where limitations in physical activity and hygienic problems

are expected to decrease after surgery, patients should understand that improving their body contour can, but does not automatically improve their psychological well-being. In chapter 4 we show that patients expectations of the post-operative result not always reflect their true motives for seeking surgery. Although patients may seek body contouring surgery for physical and hygienic skin problems they often expect changes in psychological status and social relationships after the operation. In the preoperative consultation, the plastic surgeon should address this issue with every patient and should verify that the patient understands the true benefits and limitations of body contouring surgery.

The expected benefits of body contouring surgery must outweigh the potential risks of complications and they should be weighted in the decision for body contouring surgery. Post-bariatric patients in general have greater operative risks compared to patients with the same weight without a history of morbid obesity. Many risk factors for complications after body contouring are reported in the literature, as outlined in chapter 7 and 8 of this thesis. In every patient considered for body contouring surgery, a thorough preoperative assessment of risk factors should be made.

Dutch health care legislation and body contouring surgery

The current Dutch reimbursement system plays a decisive role whether a patient will actually undergo surgery. The lack of reimbursement is one of the most important barriers for body contouring surgery in the Netherlands, as showed in chapter 4. Similar problems are reported from other countries.[9-10]

Reconstructive surgery solely based on the indication of psychological complaints, even if they are quite valid, is in the Netherlands by legislation never reimbursed. Reimbursement of reconstructive procedures is by Dutch health care insurance companies only considered when a physical deformity can be defined as mutilation or in case of a detectable physical functional impairment.

Applications for reimbursement of body contouring surgery require the completion of an online application form used by all Dutch insurance companies, through a single portal called "VECOZO". Reimbursement is determined on the basis of the patients' BMI (BMI<35) and the Pittsburgh Rating Scale (PRS). The PRS is used by the insurance companies as a measure of mutilation and by mutual agreement of the insurance companies only a deformity classified as PRS 3 is judged severe enough for reimbursement. In our study (chapter 3), the PRS could not be validated as a reliable and reproducible classification system and there seems to be no clear relation between the degree of deformity and the physical functional disorder or impairment.

The insurance companies sometimes require medical photographs of the patient for documentation and it remains unclear (for both patient and professional) who is judging or rating these photographs in the insurance bureaucracy. Therefore the whole

administrative process for the reimbursement of body contouring surgery in the Netherlands lacks both valid criteria and transparency.

Congenital or acquired body deformities can result in psychological suffering and may have a negative impact on a patients quality of life, i.e. excessive scars, skin burns or protruding ears. Taking into consideration that improvement in quality of life is one of the goals of bariatric surgery and post-bariatric body contouring, psychological complaints should be incorporated in the decision process for reimbursement. In the Netherlands for example, breast reconstruction, although it does not contribute to the primary outcome of breast cancer, is offered to all patients treated surgically for breast cancer or in whom a prophylactic ablation is carried out. Breast reconstruction is considered to enhance the quality of life and the psychological suffering women experience after an ablation apparently justifies the reimbursement of breast reconstruction. The physical and psychological stress associated with loose, hanging skin after successful weight loss can result in psychological suffering, but is apparently not classified as mutilation. This issue has not been solved yet. The fact that obesity is still considered by many as someone's individual responsibility, may also influence the discussion of reimbursement of body contouring surgery.

As obesity is classified as a chronic disease by the WHO[11] and as body contouring after massive weight loss has additional value both in terms of securing long term weight loss and enhancement of the quality of life, post-bariatric body contouring procedures should be an integral component of the treatment of morbid obesity.

FUTURE PERSPECTIVES

Within the perspective that body contouring after massive weight loss seems to contribute to the long-term effects of bariatric surgery, we propose that body contouring surgery should be part of the standard treatment of morbid obesity in careful selected patients. As discussed in this thesis, the current selection criteria for body contouring surgery are insufficient. With the rising problem of obesity and the success of bariatric surgery, we should strive for improvement of care for the massive weight loss patient. A key factor in the treatment algorithm is identification of eligible patients through careful selection. Ideally, selection should be based on the primary outcome of bariatric surgery in terms of weight-loss and improvement is co-morbidities and quality of life, the patients' risk factors for complications, the degree of skin surplus graded in objective parameters and patients' complaints and limitations due to the excess skin. In line with the patient selection for bariatric surgery, a multidisciplinary team should be involved with the selection of patients for body contouring surgery. This team ideally includes a

plastic surgeon, a bariatric surgeon, a dietician and clinical psychologist or psychiatrist. An endocrinologist can be consulted if necessary. Several conditions should be met as outlined below:

Most important, the aims of bariatric surgery must have been achieved and bariatric treatment must be completed. The optimal timing of body contouring surgery is not defined yet. The first 6-12 months rapid and massive weight loss is achieved in most patients. After 18-24 months patients experience maximum weight loss, which will be followed by slight weight gain. Surgery should not be performed before the minimum possible body mass index is reached. The question which minimum BMI should be reached before body contouring surgery can be performed is not absolute. The lower the BMI, the lower the risk for complications and a BMI<30 should be preferred. However, severe complaints and skin surplus can appear with higher BMI's and a BMI below 30 is not reached by all bariatric patients despite successful weight loss. If symptomatic skin surplus is not responding to conservative treatment or might prevent further weight loss, it is justifiable to pursue body contouring surgery with a BMI between 30 and 35. The actual weight should be stable for a minimum of three months to lower the complication risk (chapter 7) but, we advice a minimum of six months stable weight as a requirement for body contouring. The patient must have proven to be able to maintain a stable weight because post-operative weight gain or loss will be detrimental for the aesthetic result which may in turn negatively influence patient satisfaction. In addition, the nutritional status should be checked within this period and optimized before surgery. Although evidence in this particular population is lacking, nutritional deficiencies in general are related to higher complication rates after surgery. All patients should be non-smokers or quit smoking a minimum of four weeks before surgery.[12]

Consultation of a psychologist or psychiatrist is recommended if pre-existing psychopathology is present or any psychological disorder is assumed. The psychologist or psychiatrist can determine if there is no concomitant psychopathology that needs to be treated first and can assess whether the patient is emotionally stable enough to undergo surgery.

Patients are referred to the plastic surgeon only in case the aforementioned requirements are met. All patients presenting for body contouring surgery require a thorough preoperative evaluation in which the plastic surgeon evaluates what motivates patients to pursue body contouring surgery and what they expect about the post-operative result. The likely expected outcome and patients' expectations should be discussed and the plastic surgeon should make sure as much as possible that the patient has realistic expectations about the result. Showing pre- and post-operative pictures of other patients and drawings of the remaining scars might be informative. The degree

of skin surplus per body region should preferable be graded in objective parameters. After reviewing the current classification systems for body contouring, we conclude that this task remains challenging due to the wide range of contour deformities after massive weight loss and the fact that most existing classification systems are designed for aesthetic body contouring. A reliable and transparent classification is urgently needed, but has yet to be designed. After considering the pros and cons of body contouring surgery for the individual patient, the plastic surgeon finally should decide whether body contouring is indicated and will be performed.

Currently a national guideline named 'Post-bariatric Body Contouring Surgery' is being developed, initiated by the Dutch Association of Plastic Surgery (Nederlandse Vereniging voor Plastische Chirurgie; NVPC). This guideline is partly based on the studies presented in this thesis and a new classification of skin deformities will be suggested herein.

CONCLUSION

This thesis gives us more insight in the role of body contouring surgery in the surgical treatment of morbid obesity. An improvement in long-term quality of life is seen after body contouring surgery, which is one of the key goals in bariatric surgery. However, the complication rate is high as well as patients' expectations of the post-operative result, which might negatively impact patient satisfaction. Careful selection of patients is therefore of great importance. A new alternative classification system for the Pittsburgh Rating Scale will assist selection and improve reimbursement options. Future research toward prognostic factors for successful post-bariatric body contouring surgery is mandatory. This might result in better and more objective selection criteria for body contouring surgery in order to further improve the post-operative outcome in terms of long-term weight control, improvement in quality of life and decreasing the complication rate.

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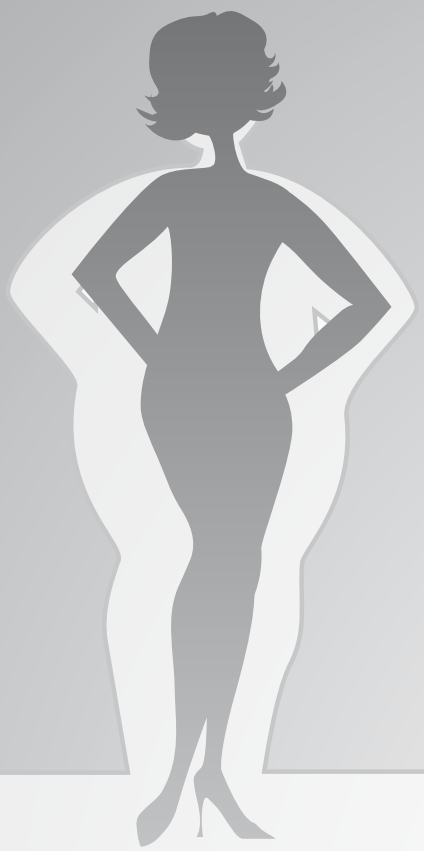

Chapter 10

Summary

Summary in Dutch – Nederlandse samenvatting

List of publications

Acknowledgements

Curriculum Vitae

The dramatic rise of morbid obesity worldwide and the success of bariatric surgery results in a significant rise in the demand for post-bariatric body contouring surgery. Massive weight loss patients present specific challenges to the plastic surgeon. The goal of this thesis was to investigate risk factors for post-operative complications, analyse clinical outcome and improve patient selection for body contouring surgery after massive weight loss.

Part I Patient selection

In this new field of plastic surgery it is important to determine which patients are suitable candidates for body contouring surgery. Clear selection criteria for this kind of surgery are lacking. When weighing the pros and cons of body contouring surgery in post-bariatric patients, it is mandatory to consider, besides anatomical parameters and risk factors, the needs and beliefs of individual patients.

In **Chapter 2** nutritional deficiencies in gastric bypass patients were evaluated as they may be in part responsible for complications after body contouring surgery. Post-operative nutritional deficiencies are a well-known side effect of bariatric surgery and these deficiencies may occur despite supplementation. Morbid obesity itself is associated with nutritional deficiencies as well. We analysed the incidence and time of onset of nutritional deficiencies in 427 post-gastric bypass patients receiving standard supplementation. The most common post-operative deficiency was of iron (25.4%) and a significant post-operative increase in the number of patients with anaemia and deficiencies of ferritin and vitamin B12 was found. Most deficiencies occurred between 12 and 15 months post-operatively, but vitamin D3 deficiency occurs significantly earlier at 9.7 months. In 270 of these 427 patients we could evaluate the prevalence of preoperative deficiencies. Deficiencies of folic acid (21.3%), vitamin D3 (17.5%) and iron (21.8%) were the most common preoperative deficiencies. A preoperative iron, folic acid or ferritin deficiency results in a significant higher risk for developing a post-operative deficiency despite supplementation, and ferritin deficiency occurs significantly earlier in these patients. The effect of supplementation of common deficiencies (ferritin, vitamin B12 and vitamin D3) was also studied. Oral treatment of post-operative vitamin B12 and vitamin D3 deficiencies was successful in more than 80% of the patients in contrast to oral treatment of anaemia, which was only successful in 62.5% of the patients. This study emphasizes the importance of pre- and post-operative assessment and treatment of nutritional deficiencies in morbidly obese patients undergoing gastric bypass surgery as the first step in prevention of post-operative deficiencies. Despite limited efficacy, post-operative oral supplementation should be encouraged as it decreases the incidence of deficiencies. The plastic surgeon should be aware of these frequently seen deficiencies, as they may negatively impact the risk of complications after body contouring surgery.

For the selection of post-bariatric patients for body contouring surgery a valid classification system for contour deformities is necessary. In **Chapter 3** the applicability of the Pittsburgh Rating Scale (PRS) was evaluated. The PRS is the only validated classification system of skin deformities occurring after massive weight loss. Thirteen trained observers (plastic surgeons, residents and specialized nurse practitioners) applied the PRS to photographs of 25 patients. The inter-observer validity and the test-retest reliability were determined. The usefulness of the PRS in daily practice was evaluated by a short questionnaire. The intra-class correlation values, as a measure of inter-observer validity, were below the threshold of 0.6 for good validity in 60% of the patients and the overall test-retest reliability has a mean weighted kappa value of 0.523. We could therefore not consistently reproduce and validate the results of the PRS. Although most of the specialists acknowledged the necessity of an adequate classification system, the PRS was only by two surgeons judged as a suitable system. A new classification system should encompass, besides anatomical parameters, items like functional disability and hygienic impairment scores and peri-operative risk factors for the individual patient.

The aim of the study presented in **Chapter 4** was to give an encompassing overview of post-bariatric patients' motives, barriers and expectations regarding body contouring surgery. First, open-minded, in-depth interviews were completed to obtain an extensive overview of those motives, barriers, and expectations from post-bariatric patients. Secondly, a card sorting task was used to let patients individually sort these statements according to similarity and relevance. Finally, a hierarchical cluster analysis was used to structure the reasons. We found that post-bariatric surgery patients are in particular motivated for body contouring surgery because of physical and hygienic skin problems, they are hold back by the costs of surgery, and they expect changes in psychological status and social relations post-operatively. Individual patients though, differ with respect to motives, barriers and expectations and the plastic surgeon should be aware of this. These subjective motives, barriers and (realistic and unrealistic) expectations can be matched to the realistic prospective result as appraised by professionals and can be helpful in the decision making for body contouring surgery. Based on the outcome of this analysis a preliminary checklist is proposed, which can be used as an useful pre-operative screening instrument.

Part II Quality of life

Massive weight loss following bariatric surgery frequently results in an excess of lax, overstretched skin. This frequently leads to physical discomfort and hygienic and psycho-social problems which may influence patients' quality of life.

In **Chapter 5** the quality of life in 43 post-bariatric patients was evaluated by a modification of the Obesity Psychosocial State Questionnaire (OPSQ), before (retrospectively

measured) and after body contouring surgery. Furthermore, complications after body contouring surgery and patient satisfaction were analyzed. Quality of life after body contouring surgery was improved significantly on six of the seven domains of the OPSQ at a mean interval of 49 months after body contouring. Most significant improvement was seen in physical functioning and physical appearance. A total of 67% of patients was satisfied with the overall result. Satisfaction was negatively influenced by post-operative weight gain but not by the occurrence of post-operative complications. To evaluate the quality of life long term after body contouring surgery, these 43 patients were invited to participate in a second study three years later (**Chapter 6**). Thirty-three patients could be included and the quality of life was measured with the same questionnaire. Compared with appraisals of quality of life before body contouring surgery, a significant sustained improvement of quality of life was observed 7.2 years after body contouring surgery in six of the seven domains. A small deterioration occurred between 4.1 and 7.2 years follow-up on two of the seven domains. Post body contouring weight gain negatively influenced quality of life. Fifty-five percent of the patients was (very) satisfied with the result of body contouring surgery. In conclusion, long-term quality of life in post-bariatric surgery patients after body contouring is significantly improved compared with their appraisal of preoperative quality of life. Therefore, body contouring surgery is beneficial in the treatment of morbid obesity and should be included in the continuum of care of morbid obesity patients.

Part III Complications

The third part of this thesis focuses on post-operative complications. Post-bariatric body contouring surgery is associated with a high complication rate which negatively affects the potential benefits.

In **Chapter 7** we analyzed the results of body contouring surgery in patients after laparoscopic gastric banding. Data of 43 post-bariatric patients were retrospectively reviewed. Complications were categorized according to the modified Clavien classification and all cases were analyzed for risk factors. We found an overall complication rate of 27.9% and most of the complications were of grade 2 (requiring only pharmacological treatment). Abdominoplasty was the most performed procedure and this operation was found to have the highest risk for both minor and major complications. A stable weight over a period of at least 3 months prior to surgery is associated with a significant lower complication rate. It is likely that the nutritional status of these patients is better because the body is no longer katabolic, as in the weight loss phase.

Patients' BMI and percentage of excess weight loss were found to be highly significant risk factors for complications. This study emphasizes the importance to strive for a weight close to normal which is at least three months stable in order to minimize the complication risk.

In **Chapter 8** we studied the complications of body contouring surgery in post-gastric bypass patients. A gastric bypass is both a malabsorptive as well as a restrictive procedure with a considerable risk for nutritional deficiencies. This risk is higher compared to the risk for deficiencies after laparoscopic banding, a purely restrictive procedure. In general, patients with nutritional deficiencies not only have slower wound healing, but also a greater risk of developing wound infections. In this study, a complication rate of 40.3% was found and most complications concerned wound healing complications. The prevalence of preoperative nutritional deficiencies was higher in the group with postoperative complications compared to patients without complications, but the difference did not reach statistical significance and no firm conclusions could be drawn from this retrospective study regarding the role of nutritional deficiencies as an independent risk factor. Future prospective studies should focus on the impact of nutritional status on complication rate in post-bariatric body contouring patients.

In conclusion, an improvement in long term quality of life is seen after body contouring surgery, which is one of the key goals of bariatric surgery. Within this perspective, body contouring surgery should be part of the treatment of morbid obese patients. On the other hand, the complication rate is high and patients' expectations of the aesthetic result and physical and psychosocial benefits may be unrealistic and not always reflect their true motives for body contouring surgery. Therefore, it is of great importance to outline a realistic picture of the risks and benefits of surgery in the decision whether the individual patient is a suitable candidate for body contouring surgery.

NEDERLANDSE SAMENVATTING

De enorme toename van morbide obesitas wereldwijd en het succes van bariatrische chirurgie resulteert in een toenemende vraag naar post-bariatrische contour herstellende chirurgie. Patiënten die zich na extreem gewichtsverlies bij de plastisch chirurg presenteren, vormen een specifieke en uitdagende patiëntenpopulatie. Het doel van dit proefschrift was om de risicofactoren voor postoperatieve complicaties te onderzoeken, de klinische uitkomst te analyseren en de patiënten selectie voor contour herstellende chirurgie bij post-bariatrische patiënten te verbeteren.

Deel I Patiënten selectie

In dit binnen de plastische chirurgie nieuwe aandachtsgebied is het belangrijk om te bepalen welke patiënten geschikte kandidaten zijn voor contour herstellende chirurgie. Duidelijke selectie criteria voor deze vorm van chirurgie ontbreken. Bij het afwegen van de voor- en nadelen van contour herstellende chirurgie bij post-bariatrische patiënten, is het aan te raden om naast anatomische parameters en risicofactoren, de wensen en overtuigingen van individuele patiënten mee te wegen in de selectie.

In **hoofdstuk 2** hebben we de voedingsdeficiënties bij gastric-bypass patiënten geëvalueerd. Deze kunnen deels verantwoordelijk zijn voor het optreden van complicaties na contour herstellende chirurgie. Postoperatieve voedingsdeficiënties zijn een bekend gevolg van bariatrische chirurgie en deze tekorten treden op ondanks suppletie. Morbide obesitas zelf wordt ook geassocieerd met voedingstekorten. We analyseerden de incidentie en het tijdstip van ontstaan van voedingsdeficiënties bij 427 post-gastric bypass patiënten die standaard suppletie ontvingen. De meest voorkomende postoperatieve deficiëntie was die van ijzer (25,4%) en we zagen postoperatief een significante toename van het aantal patiënten met anemie en met een ferritine en vitamine B12 deficiëntie. De meeste deficiënties ontstonden tussen de 12 en 15 maanden na de operatie, maar vitamine D3 deficiëntie ontstond aanzienlijk eerder en wel op 9,7 maanden postoperatief. In 270 van deze 427 patiënten konden we tevens de prevalentie van preoperatieve deficiënties evalueren. Deficiënties van foliumzuur (21,3%), vitamine D3 (17,5%) en ijzer (21,8%) waren de meest voorkomende preoperatieve deficiënties. Een preoperatieve deficiëntie van ijzer, foliumzuur of ferritine resulteert in een significant hoger risico op het ontwikkelen van een postoperatieve deficiëntie ondanks suppletie en tevens trad een ferritine deficiëntie veel eerder op bij deze patiënten.

Het effect van suppletie van de meest voorkomende deficiënties (ferritine, vitamine B12 en vitamine D3) werd ook bestudeerd. Orale behandeling van een postoperatieve vitamine B12 en vitamine D3 deficiëntie was succesvol in meer dan 80% van de patiënten in tegenstelling tot de orale behandeling van anemie, welke slechts in 62,5% van de patiënten succesvol was. Deze studie benadrukt het belang van het pre- en postoperatieve in kaart brengen en bepalen van voedingsdeficiënties in morbide obese patiënten die een gastric-bypass hebben ondergaan. Dit is een eerste stap in de preventie van postoperatieve deficiënties. Ondanks dat het effect van postoperatieve suppletie gelimiteerd is, dient postoperatieve orale suppletie aangemoedigd te worden aangezien het de incidentie van deficiënties vermindert. De plastisch chirurg moet zich te allen tijde bewust zijn van deze veel voorkomende deficiënties, aangezien deze negatief van invloed kunnen zijn op het optreden van complicaties na contour herstellende chirurgie.

Voor de selectie van post-bariatrische patiënten voor contour herstellende chirurgie is een valide en betrouwbaar classificatiesysteem voor de mate van huidoverschot noodzakelijk. In **hoofdstuk 3** is de toepasselijkheid van de Pittsburgh Rating Scale (PRS) geevalueerd. De PRS is het enige gevalideerde classificatiesysteem voor het huidoverschot dat ontstaat na fors gewichtsverlies. Dertien beoordelaars (plastisch chirurgen, plastisch chirurgen i.o. en nurse practitioners bariatrische chirurgie) pasten de PRS toe op foto's van 25 patiënten. De *interrater validity* en de *test-retest reliability* werden bepaald. De toepasbaarheid van de PRS in de dagelijkse praktijk werd geëvalueerd middels een korte vragenlijst. De *intra-class* correlatie waarden, die als maat golden voor de *interrater validity* waren onder de drempel van 0,6 hetgeen staat voor een goede validiteit in 60% van de patiënten en de totale *test-retest reliability* had een gemiddelde gewogen kappa waarde van 0,523. We konden de resultaten van de PRS dientengevolge niet reproduceren en valideren. Hoewel de meeste plastisch chirurgen en plastisch chirurgen i.o. de noodzaak van een adequaat classificatiesysteem erkenden, werd de PRS slechts door twee plastisch chirurgen beoordeeld als een geschikt classificatiesysteem. Een nieuwe classificatiesysteem zou, naast anatomische parameters, items zoals functiebeperking, hygiënisch problemen en peri-operatieve risicofactoren voor de individuele patiënt moeten bevatten.

Het doel van de studie beschreven in **hoofdstuk 4** is het geven van een overzicht van de motivaties, belemmeringen en verwachtingen van post-bariatrische patiënten ten aanzien van contour herstellende chirurgie. Eerst werden diepte interviews afgenomen met open vragen om een overzicht te krijgen van de verschillende motieven, belemmeringen en verwachtingen die spelen bij post-bariatrische patiënten. Deze interviews lieten verschillende uitspraken zien. Vervolgens verrichtte elke patiënt een kaartsoorteertaak waarbij zij individueel de uitspraken verdeelden op basis van gelijkheid en relevantie.

Uiteindelijk werd doormiddel van een hiërarchische clusteranalyse structuur gebracht in de motieven, belemmeringen en verwachtingen.

Wij vonden dat post-bariatrische patiënten met name gemotiveerd zijn voor contour herstellende chirurgie vanwege fysieke en hygiënische klachten (huidproblemen), de kosten voor de operatie de grootste belemmering vormen en zij postoperatief veranderingen verwachten op psychologisch gebied en op het vlak van sociale relaties. De motivaties, belemmeringen en verwachtingen verschillen per patiënt en de plastisch chirurg moet zich hiervan bewust zijn. In de beslissing of contour herstellende chirurgie geïndiceerd is in de individuele patiënt, kan het zinvol zijn deze subjectieve motivaties, belemmeringen en verwachtingen mee te wegen en te vergelijken met realistische verwachtingen van het postoperatieve resultaat gezien vanuit professioneel oogpunt. Op basis van de uitkomsten van deze studie is een voorlopige checklist gemaakt, welke kan worden gebruikt als een preoperatief screeningsinstrument bij post-bariatrische patiënten die contourherstellende chirurgie willen ondergaan.

Deel II Kwaliteit van leven

Fors gewichtsverlies na bariatrische chirurgie resulteert vaak in een overschot van uitgerekte huid. Dit kan leiden tot fysieke klachten en hygiënische en psychosociale problemen, die de kwaliteit van leven negatief kunnen beïnvloeden. In **hoofdstuk 5** is de kwaliteit van leven vóór (retrospectief bepaald) en na contour herstellende chirurgie bij 43 post-bariatrische patiënten geëvalueerd. Hierbij werd gebruik gemaakt van een modificatie van de *Obesity Psychosocial State Questionnaire* (OPSQ). Daarnaast werden de postoperatieve complicaties en de patiënttevredenheid geanalyseerd. Na een gemiddelde follow-up van 49 maanden na contour herstellende chirurgie was er sprake van een significante verbetering van de kwaliteit van leven op zes van de zeven domeinen van de OPSQ. De grootste verandering werd gezien op het vlak van fysiek functioneren en uiterlijk. In totaal was 67% van de patiënten tevreden met het uiteindelijke resultaat. De tevredenheid van patiënten werd negatief beïnvloed door postoperatieve gewichtstoename, maar niet door het optreden van complicaties.

Om de kwaliteit van leven op de lange termijn na contourherstellende chirurgie te evalueren, werden deze 43 patiënten drie jaar later opnieuw uitgenodigd om deel te nemen aan een studie (**hoofdstuk 6**). Er konden 33 patiënten worden geïncludeerd en de kwaliteit van leven werd gemeten met dezelfde vragenlijst. In vergelijking van de kwaliteit van leven vóór contourherstellende chirurgie, werd er na een follow-up van 7.2 jaar een significante verbetering van kwaliteit van leven gezien op zes van de zeven domeinen van de OPSQ. Op twee van de zeven domeinen van de OPSQ werd een kleine afname van kwaliteit van leven gezien tussen 4.1 en 7.2 jaar follow-up. Gewichtstoename na contour herstellende chirurgie heeft een negatieve invloed op de kwaliteit

van leven. In totaal was 55% van de patiënten (zeer) tevreden met het uiteindelijke resultaat.

Concluderend kunnen we stellen dat de kwaliteit van leven bij post-bariatrische patiënten die contour herstellende chirurgie hebben ondergaan ook op de lange termijn significant beter is ten aanzien van de door hen ervaren kwaliteit van leven vóór contourherstellende chirurgie. Contour herstellende chirurgie is dan ook een waardevolle toevoeging in de behandeling van morbide obesitas en zou onderdeel uit moeten maken van de zorg voor de morbide obese patiënt.

Deel III Complicaties

Het derde deel van dit proefschrift richt zich op postoperatieve complicaties. Post-bariatrische chirurgie gaat gepaard met een hoog complicatiepercentage wat de potentieel gunstige resultaten negatief zou kunnen beïnvloeden.

In **hoofdstuk 7** analyseerden we de resultaten van contour herstellende chirurgie in voornamelijk patiënten die een laparoscopische maagband operatie hebben ondergaan. De data van 43 post-bariatrische patiënten werden retrospectief geanalyseerd.

Complicaties werden aan de hand van de Clavien classificatie is categorieën verdeeld en er werd een analyse verricht naar risicofactoren. Wij vonden een complicatiepercentage van 27.9% en het betrof met name graad 2 complicaties (medicamenteuze behandeling geïndiceerd). Een abdominoplastiek was de meeste uitgevoerde operatie en deze operatie werd het meest geassocieerd met zowel milde als ernstige complicaties.

Een stabiel gewicht over een periode van minimaal drie maanden voorafgaand aan contour herstellende chirurgie is geassocieerd met een significant lager complicatie percentage. Het is aannemelijk dat de voedingsstatus van deze patiënten beter is nu ze niet langer katabool zijn zoals in de fase van gewichtsverlies. Het huidige BMI en de mate van gewichtsverlies ('*excess weight loss*') bleken significante risicofactoren te zijn voor het optreden van complicaties. Deze studie benadrukt dat het belangrijk is te streven naar een gezond gewicht dat minimaal drie maanden stabiel is, om het complicatiepercentage te verminderen.

In **hoofdstuk 8** worden de complicaties na contour herstellende chirurgie beschreven bij patiënten die een *gastric bypass* hebben ondergaan. Een *gastric bypass* is zowel een malabsorptieve als ook een restrictieve operatie hetgeen resulteert in een aanzienlijk risico op voedingstekorten. Dit risico wordt groter geacht in vergelijking met het risico op deficiënties na een maagband, aangezien deze ingreep een zuiver restrictieve operatie betreft. In het algemeen hebben patiënten met voedingsdeficiënties zowel een tragere wondgenezing als ook een groter risico op wondgenezingsstoornissen. In deze studie vonden we een complicatiepercentage van 40.3% en het betrof met name wondgenezingsstoornissen. De prevalentie van preoperatieve voedingsdeficiënties was

hoger in de groep patiënten met postoperatieve complicaties vergeleken met patiënten die geen complicaties hadden, echter dit verschil was niet significant. Er konden geen conclusies worden getrokken uit deze retrospectieve studie en de vraag of het bestaan van voedingsdeficiënties een onafhankelijke risicofactor is voor het optreden van post-operatieve complicaties bij post-bariatrische patiënten blijft onbeantwoord. Prospectieve studies naar de rol van voedingsdeficiënties bij het optreden van complicaties na contour herstellende chirurgie in post-bariatrische patiënten moeten in de toekomst meer duidelijkheid geven.

Concluderend kunnen we stellen dat er een verbetering van kwaliteit van leven gezien wordt na contour herstellende chirurgie bij post-bariatische patiënten, hetgeen één van de doelen van bariatrische chirurgie is. Vanuit dit perspectief zou contour herstellende chirurgie onderdeel moeten uitmaken van de behandeling van morbide obesitas. Echter, het complicatie percentage is hoog en de patiënt heeft vaak hoge verwachtingen van het postoperatieve esthetische resultaat en van de positieve fysieke en psychosociale effecten. Deze verwachtingen kunnen onrealistisch zijn en daarnaast komen deze verwachtingen niet altijd overeen met de genoemde motieven voor contour herstellende chirurgie. Het is dan ook van groot belang om voor elke individuele patiënt een realistisch beeld te maken van de peri-operatieve risico's en de te verwachten voordelen van een operatie om zo tot een beslissing te komen of de patiënt een geschikte kandidaat is voor contour herstellende chirurgie.

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CURRICULUM VITAE

Eva van der Beek was born on February 22nd, 1982, in Eindhoven, The Netherlands. She graduated from the Marnix College in Ede in 2000 and studied Human Movement Science at Groningen University from 2000-2001. In 2001 she started medical school at Groningen University. At the end of 2005 she started her clinical rotations at the Deventer Hospital in Deventer. In the beginning of 2007 she followed an internship Surgery at the Academic Hospital of Paramaribo, Suriname. During her last clinical rotation at the Department of Surgery of the St. Antonius Hospital, Nieuwegein she started the research described in this thesis. She obtained her medical degree in December 2007. In January 2008 she started working at the Department of Surgery, Meander Medical Center in Amersfoort. From September 2008 she worked at the Department of Plastic and Reconstructive surgery of the St. Antonius Hospital in Nieuwegein and of the Diakonessenhuis, Utrecht. At the end of 2009 she was member of a plastic surgery team at Ambon. In April 2010 she started her residency program in plastic and reconstructive surgery, spending the first two years in general surgery at the St. Antonius Hospital in Nieuwegein (Dr. P.M.N.Y.H. Go) and from April 2012 her plastic and reconstructive surgery program is scheduled in the University Medical Center Utrecht (Dr. A. Schuurman) and in the St. Antonius Hospital in Nieuwegein (Dr. A.B. Mink van der Molen). Beside her clinical practice she participated in the development of the Dutch guideline 'Post-bariatric body contouring surgery'.

She is married to Frederik Hoogwater and in May 2015 they expect their first child.