Increased morbidity in patients undergoing abdominoplasty after laparoscopic gastric bypass

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ABSTRACT

INTRODUCTION: 30-40% of the adult population in Denmark are overweight and 10-13% are obese. The number of bariatric operations reached 3,000 in 2009, and it is expected that a third or more of the patients need corrective plastic surgery.

MATERIAL AND METHODS: Medical charts of all patients who had abdominoplasty performed during a 2.5-year period. We included 72 patients of whom 21 had lost weight after bariatric surgery and 51 patients had lost weight through diet and exercise or had not been overweight.

RESULTS: The overall complication rate was 21% (43% of the post-bariatric patients and 12% of the non-post-bariatric patients, $p < 0.01$). When adjusted for the maximum body mass index (BMI) and BMI at the time of abdominoplasty, post-bariatric patients still had a higher complication rate than non post-pariatric patients (OR = 4.8; 95% CI: 0.92-25.04). Post-bariatric patients had a significantly higher maximum weight, weight at the time of abdominoplasty and had lost more BMI units.

CONCLUSION: Our data show that post-bariatric patients who have an abdominoplasty performed suffer a high complication rate which appears to be higher than that of patients who do not have bariatric surgery. We have also shown a tendency towards increased costs of abdominoplasty in post-bariatric patients due to a slightly longer operating time and more postoperative office visits.

ORIGINAL ARTICLE

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According to the Danish National Board of Health, the prevalence of obesity in Denmark has increased by almost 75% since 1987 [1]. About 30-40% of the adult population are overweight (body mass index, BMI ≥ 25 kg/m^2) and 10-13% are obese (BMI ≥ 30 kg/m^2)).

In Denmark the two most common surgical procedures in the treatment for excessive overweight are laparoscopic gastric banding and gastric bypass [2]. The number of bariatric operations increased from 80 in 2004 [3] to 3,000 in 2009 [4]. It is estimated that the future annual number of bariatric operations in Denmark will reach approx. 5,000 [5]. The need for body contouring surgery rises with the growing use of bariatric surgery for morbid obesity. The increase in redundant skin folds interferes with exercise, fitting clothes, sexual activity and with maintaining adequate hygiene and it may cause recurrent fungal infection of intertriginous regions. It is estimated that a third or more of the patients will need corrective plastic surgery for these functional problems [5].

Patients lose 50-70% of their excess weight during the first year after bariatric surgery (BS). After 18 to 24 months, almost all have stopped losing weight. The best time for body contouring surgery is therefore probably 18 to 24 months after BS [6, 7].

It is well known that nutrition influences the process of wound healing, so that depletion may cause a rise in the occurrence of wound infection and/or delayed healing. Many post-bariatric patients are nutritionally deficient due to a lower vitamin and mineral intake, and multivitamin supplement compliance is generally poor [6, 7]. Furthermore, the skin quality of post-bariatric patients is diminished [8]. An increase in the number of complications after body contouring surgery may therefore be expected.

MATERIAL AND METHODS

A retrospective study was performed that included all patients who had undergone abdominoplasty at The Department of Plastic Surgery, Roskilde Hospital, during the 2.5-year period from January 2007 to June 2009. All medical records were reviewed. The Department generally requires that patients have a BMI ≤ 25 kg/m^2 for them to be approved for a full abdominoplasty. All 72 consecutive patients operated during the study period were included. Twenty-one patients (29%) had lost weight after BS (18 gastric bypasses and three gastric bandings), and 51 patients (71%) had lost weight through diet and exercise or had not been overweight.

The abdominoplasty technique included a W-type lower abdominal incision or a Fleur-de-lis with a vertical incision. Undermining was done extensively over the rectus abdominus muscle up to the xyphoid. In most cases, minimal undermining was performed laterally to the rectal muscles. In some cases, plication sutures were placed along the midline to correct a rectus diastasis, and some patients also had plication sutures from the superficial fascia to the rectal fascia in order to lift a descended pubic mound. Most patients had two drains

inserted. The defect was closed with resorbable sutures in the superficial fascia and dermis, and resorbable sutures, non-resorbable sutures or staples in the skin.

For each patient, the following data were registered: sex, age at the time of body contouring surgery, medical history, maximum BMI before weight loss, BMI at the time of abdominoplasty, weight loss method, whether the patient had a stable weight for > 6 months before body contouring surgery, time from BS to presurgical evaluation and abdominoplasty, smoking and diabetic status, time in operating room, knife time, weight of tissue resection, blood loss during surgery, period drainage was used, total drain secretion, duration of hospitalisation, number of postoperative office visits until dismissal or corrective surgery, follow-up time, complications and reoperations. Minor complications recorded were haematoma or seroma not requiring intervention, superficial wound infection, and minor cases of delayed wound healing. Major complications were haematoma, wound infection and skin necrosis requiring surgical intervention and seroma requiring aspiration.

Trial registration: not relevant.

Statistical analysis

Fisher's exact test was used for statistical analysis of qualitative data and Mann-Whitney's test for analysis of quantitative data. These analyses were performed using the Instat Statistical Software (version 3.10, Graphpad, USA). Multiple logistic regression models were used to establish the influence of BMI and BS on the complication rate. Odds ratios (OR) and 95% confidence intervals (CI) were calculated, and the Wald test was used to test the overall significance of each parameter. Two-tailed p-values were applied and the level of significance was set to 5% for all statistical tests. The multivariate analyses were done using SAS 9.1 (SAS Institute, Cary, NC, USA).

RESULTS

The demographics of the post-bariatric versus the non-post-bariatric patients were rather similar except for the maximum weight, weight at the time of abdominoplasty and weight loss (**Table 1**). Post-bariatric patients had a significantly higher maximum weight as well as a higher weight at the time of abdominoplasty, and they had lost more BMI units than the patients with no bariatric surgery. In both groups, the majority of the patients were female, and age and smoking habits in the two groups were also quite similar (Table 1).

The median time spent in the operating room was 175 min. for the non-post-bariatric abdominoplasties and 190 min. for the post-bariatric abdominoplasties (p = 0.03). As expected, the same pattern was seen for the knife time with a median of 120 min. and 125 min. for the non- and post-bariatric abdominoplasties, respectively (p = 0.12). The weight of tissue resection varied from 280 g to 2.75 kg; significantly more in the post-bariatric patients (median 1,200 g) than in the non-post-bariatric patients (median 700 g) (p < 0.01). The patients were hospitalised for 1-13 days with a median of three days in both groups (Table 1). There was no difference in drainage time and output with a median of three days and a median output of 105 ml and 114 ml in the post-bariatric and the non-post-bariatric patients, respectively (p = 0.63).

Sixty-three of the 72 patients had a follow-up of at least three months. The remaining nine patients did not show up or did not wish to be seen three months postoperatively. The overall complication rate was 21% (**Table 2**). Seven percent of the patients had a major complication that required surgical intervention or aspiration and 18% had a minor complication. No patients died or developed more serious complications such as deep venous thrombosis or pulmonary embolism. Forty-three percent of the post-bariatric patients had a complication, whereas only 12% of the non-post-bariatric patients had a complication (p < 0.01, Table 2). When adjusted for maximum BMI and BMI at the time of abdominoplasty by use of multivariate analyses, the post-bariatric patients still had a higher complication rate than patients with no bariatric surgery (OR 4.8; 95% CI

TABLE 1

Patient characteristics and outcome data.

	Post-bariatric surgery (n = 21)	No bariatric surgery (n = 51)	p value
Sex, n (%)			
Men	1 (5)	2 (4)	1.00
Women	20 (95)	49 (96)	
Age, years, median (range)	42 (27-56)	41 (29-67)	0.62
Smoking, n (%)			
No smoking	15 (71)	33 (65)	
0-10 cigarettes/day	3 (14)	4 (8)	0.40
> 10 cigarettes/day	3 (14)	14 (27)	
Maximum BMI, kg/m^2, median (range)	48 (41-61)	36 (20-54)	< 0.01
BMI loss, kg/m^2, median (range)	22 (17-32)	12 (0-28)	< 0.01
Weight loss, kg, median (range)	60 (47-87)	35 (0-86)	< 0.01
BMI at the time of abdominoplasty, kg/m^2, median (range)	26 (23-29)	24 (20-28)	< 0.01
Time in operating room, min.[a], median (range)	190 (145-295)	175 (130-280)	0.03
Operative time, min., median (range)	125 (90-232)	120 (80-193)	0.12
Weight of tissue resection, g, median (range)	1,200 (300-2,100)	700 (280-2,750)	< 0.01
Duration of hospitalization, days, median (range)	3 (2-13)	3 (1-13)	0.90
Drainage used, n (%)	21 (100)	49 (96)	1.00
Drainage time, days, median (range)	3 (2-13)	3 (1-9)	0.52
Drain secretion, ml, median (range)	105 (0-1,320)	114 (10-1,700)	0.63

BMI = body mass index.
a) From the patient entered the room until the anaesthesia was terminated.

0.92-25.04, **Table 3**). Increased BMI before weight loss and before abdominoplasty did not affect the risk of complications when adjusted for gastric bypass surgery. This was the only explanatory variable associated with the risk of complications in this study.

Three patients developed a postoperative haematoma of which one required surgical intervention. This post-bariatric patient was readmitted for 28 days due to an infected haematoma with necrotizing skin. The patient's abdominal defect was eventually covered with a split-thickness skin graft and she needed blood transfusion due to anaemia (**Figure 1**).

The most frequent complication was infection (17% in total; 33% of the post-bariatric patients and 10% of the non-post-bariatric patients, p = 0.03). Heavy smokers (> 10 cigarettes per day) had an infection rate of 24% compared with 17% among non-smokers (p = 0.46). Seroma occurred in three patients of whom two required aspiration. All three patients had had drains that were removed on the second, third, and seventh day, respectively.

Only one patient had diabetes (Type 2) and this patient did not develop complications. No other co-morbidities were reported.

Twenty-two patients had corrective surgery performed, the majority had dog ears corrected and a few patients underwent a re-abdominoplasty as a Fleur-delis or a regular abdominoplasty to excise more excess skin or to lift the pubic mound (Table 2).

TABLE 2

Complications.[a]

	Post-bariatric abdomino-plasty (n = 21)	Non-post-bariatric abdomino-plasty (n = 51)	p value
Haematoma, n (%)			
Not requiring surgical intervention	1	1	
Requiring surgical intervention	1	0	0.20
Total	2 (10)	1 (2)	
Infection requiring antibiotics, n (%)			
Superficial	5	5	
Deep	2	0	0.03
Total	7 (33)	5 (10)	
Seroma, n (%)			
Not requiring drainage	1	0	
Requiring drainage	1	1	0.20
Total	2 (10)	1 (2)	
Patients with minor complications[b], n (%)	7 (33)	6 (12)	0.04
Patients with major complications[c], n (%)	4 (19)	1 (2)	0.02
Patients with complications, n (%)	9 (43)	6 (12)	< 0.01
Corrective surgery, n (%)			
Correction of dog ears	6[d] (29)	14 (27)	
Reabdominoplasty (Fleur-de-lis or correction of pubic mound)	1 (5)	2 (4)	
Other	1[e] (5)	0	
Total	8 (38)	14 (31)	0.41

a) A min. three-month follow-up period was achieved for 18 of the post-bariatric patients after abdominoplasty and 45 of the non-post-bariatric patients after abdominoplasty; b) Minor complications: haematoma or seroma not requiring intervention and superficial wound infection; c) Major complications: haematoma, wound infection and skin necrosis that required surgical intervention and seroma that required aspiration; d) Two patients have not yet been evaluated for corrective surgery; e) Operated for a suture granuloma and fistula.

TABLE 3

Multiple logistic regression testing the effect of bariatric surgery, body mass index (BMI) before bariatric surgery and BMI after bariatric surgery on the risk of a complication.

Variable	Odds ratio	95% confidence interval
Bariatric surgery	4.81	0.92-25.04
BMI before bariatric surgery	0.95	0.84-1.08
BMI after bariatric surgery	1.10	0.70-1,072

DISCUSSION

Complications after body contouring surgery are common and have previously been reported [9-15]. Some studies report an increase in the complication rate in post-bariatric patients, but others have shown that this increase is due to the high preoperative BMI observed among those who undergo BS.

We found an overall complication rate of 21%. We have assumed that the patients who did not wish to be seen three months postoperatively had no substantial problems. Post-bariatric patients had a significantly higher risk of developing complications after abdominoplasty than non-post-bariatric patients (43% versus 12%, p < 0.01). When adjusted for the maximum BMI and BMI at the time of abdominoplasty, post-bariatric patients had an almost five times higher risk of complications than non-post-bariatric patients. Considering this rather high OR, a larger study size may be required to show a significant difference in the complication rate between the two groups. By univariate analysis of these parameters, we found a significant increase in complication rate with increase in maximum BMI (p = 0.02) and a non-significant increase in complication rate with BMI ≥ 25 kg/m^2 at the time of abdominoplasty (p = 0.23). When we adjusted for bariatric surgery, this increase in complication rate with increasing BMI was eliminated, which indicates that the higher complication rate was caused by bariatric surgery.

It is difficult to compare current literature due to the different definitions used for minor and major complications. In addition, BMI at the time of body contouring also varies greatly across studies. In the study period covered by our Department, the patients were required to have a BMI not substantially exceeding 25 kg/m^2 to be approved for abdominoplasty and therefore no pa-

FIGURE 1

A 33 year-old non-smoking woman who had a gastric bypass 1.5 years earlier. She had lost 61 kg from a maximum weight of 130 kg. An abdominoplasty was performed with resection of 1,000 g of tissue and correction of her rectal diastasis. She was discharged after three days. Six days after surgery she was readmitted with an infected haematoma and necrosis of parts of the abdominal wall and the overlying skin. The wound was surgically revised and all necroses removed. Negative pressure wound therapy was applied for 16 days before the wound was closed with a split skin.

tients had a BMI ≥ 30 kg/m^2. It has previously been reported that patients with a BMI < 25 kg/m^2 at the time of body contouring surgery had a 3.3% risk of developing minor complications (infection, seroma, minor wound problems) and a 6.7% risk of developing a major complication (significant wound healing problems, dehiscence, readmission, re-operation, tissue necrosis, death) [9]. At a BMI of 25-30 kg/m^2, a total of 18.2% developed minor and 13.6% developed major complications. For patients with a BMI > 40 kg/m^2, the numbers were 46.9% and 43.8%, respectively. This increase in complication rate with increasing BMI was statistically significant. In a prospective study of 449 post-bariatric reconstructive patients, Coon et al also found that current BMI may impact complications in single-procedure cases [10]. It seems that the BMI at the time of body contouring surgery profoundly increases the complication rate. Besides obesity, other risk factors have been shown to increase the complication rates after body contouring surgery considerably. Several studies revealed that smoking increases the complication rate [11, 12, 14, 16]. Smokers had a relative risk of postoperative infections of 12-14 and had a higher rate of wound healing problems after aesthetic and post-bariatric abdominoplasty than non-smokers [14, 16]. Araco et al found that the larger the number of cigarettes smoked per day, the more years of smoking, and the higher the estimated overall number of cigarettes, the greater the association with infection [16]. Manassa et al found that 47.9% of the smokers showed wound healing problems before hospital discharge compared with 14.8% of the non-smokers [17]. In our study, we failed to find a significant association between smoking and infection rate, but heavy smokers (> 10 cigarettes per day) had a risk of postoperative infection of 24% compared with a 17% risk among non-smokers (non-significant). A true association may exist, but is possibly hidden due to small numbers.

We found a rather low rate of seroma in our study (4.2%). Others have reported seromas to occur in 4.7-17.4% of cases after full abdominoplasty [12, 15, 18]. It is difficult to compare the different studies for several reasons. The studies do not share a single definition of a clinically acknowledgeable seroma, the resection weight varies due to differences in pre-surgical BMI, and the operation technique may vary as well. It has been shown that a high amount of resected fat gives more seromas, especially when exceeding 700 g, and the use of an electric knife for flap dissection has been shown to cause fewer seromas [19].

Hensel et al performed a patient survey that revealed symptom improvement in 95% of the patients who had undergone abdominoplasty, and showed that 86% of the patients were satisfied with their result [11]. Shermak et al also showed that body contouring seems to improve functioning and body image, while it does not stimulate the patient to lose further weight [1, 20].

One might expect the post-bariatric patients to cost more in terms of operation time, hospitalization and corrective surgery. In our study, the difference in costs between the two groups was limited. The time in the operating room was 15 min. longer for post-bariatric patients (significant) and the mean number of postoperative office visits was three for the post-bariatric patients and two for non-post-bariatric patients, but there was no measurable difference in duration of hospitalization and amount of corrective surgery between the two groups. The difference may be too small to detect in our material.

Our data show that post-bariatric patients who had an abdominoplasty performed had a higher complication rate than patients who did not undergo bariatric surgery. It seems that the higher risk is unaffected by a higher setoff BMI and by BMI at the time of abdominoplasty. Other yet unknown factors such as malabsorption influencing heeling probably explain some of the higher risk of complications. The patients should be informed of this greater risk before giving their consent to operation. We have also shown a tendency towards higher costs of abdominoplasty in post-bariatric patients due to a slightly longer operating time and more postoperative office visits. As an increasing number of post-bariatric patients seek body contouring, this field needs further exploration.

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