Complications of Lower Body Lift Surgery in Postbariatric Patients

Ingrid G.M. Poodt, MD
Martine M. van Dijk, MD
Steven Klein, MD, PhD
Maarten M. Hoogbergen, MD, PhD

Background: There is an exponential rise of patients with massive weight loss because of bariatric surgery or lifestyle changes. The result is an increase of patients with folds of redundant skin that may cause physical and psychological problems. The lower body lift is a procedure to correct deformities in the abdomen, mons, flanks, lateral thighs, and buttocks. Complication rates are quite high and could negatively affect the positive outcomes. The purpose of this study is to assess complication rates and to identify predictors of complications to optimize outcomes for patients after lower body lift surgery.

Methods: A retrospective analysis of 100 patients who underwent a lower body lift procedure was performed. The patients were reviewed for complications, demographic data, comorbidities, smoking, highest lifetime body mass index, body mass index before lower body lift surgery, percentage of excess weight loss, and amount of tissue excised.

Results: The overall complication rate was 78%. Twenty-two percent of the patients had major complications and 56% had minor complications. There is a linear relationship between body mass index before lower body lift surgery and complications ($P = 0.03$). The percentage of excess weight loss (odds ratio [OR] 0.97; 95% confidence interval [CI] 0.92–1.00), highest lifetime body mass index (OR 1.08; 95% CI 1.01–1.15), body mass index before lower body lift surgery (OR 1.17; 95% CI 1.02–1.33), and smoking (OR 7.74; CI 0.98–61.16) are significantly associated with the development of complications.

Conclusions: This study emphasizes the importance of a good weight status before surgery and cessation of smoking to minimize the risk of complications. (Plast Reconstr Surg Glob Open 2016;4:e1030; doi: 10.1097/GOX.0000000000001030; Published online 29 September 2016.)
diastasis, and liposuction is used selectively in case of persistent fullness in particular regions.4

Lower body lifts are considered elective surgery, and thus require a careful risk/benefit evaluation for each patient. Although these operations are associated with an increase in quality of life and high patient satisfaction,5,6 the relative high complication rates can affect these positive experiences negatively.7,8

Most of the published work related to this issue summarizes complication rates and risk factors among different types of body contouring surgery, but concrete data associated with a lower body lift are limited.7–14

The aim of this study is to identify complications and possible risk factors of lower body lift surgery to optimize patient selection and timing for this particular procedure.

PATIENTS AND METHODS

Patients
All patients who underwent lower body lift surgery in the Catharina Hospital Eindhoven between January 2007 and January 2015 were included in this study. Patients were excluded if essential parts of the patient charts were missing.

Data Collection
A retrospective chart review was performed. The following data and variables were collected: age, sex, highest lifetime body mass index (BMI max), BMI before lower body lift surgery (BMI pre-LBL), type of weight loss, bariatric surgery or lifestyle change with diet and/or sports, percentage of excess weight loss, weight of resected tissue, operation time, duration of hospital stay, smoking history, use of nutritional supplements, and comorbidity.

Patients with a positive history of smoking were encouraged to stop smoking at least 6 weeks before surgery. Patients who smoked 6 weeks before surgery were qualified as smokers.

Outcome
Follow-up time was 6 months after lower body lift surgery.

The documentation of complications included wound dehiscence, seroma, hematoma, surgical site infection, skin necrosis, deep venous thrombosis, and pulmonary embolism. The interventions associated with a complication were documented, including aspiration of seroma, antibiotic treatment, debridement, VAC treatment, and reoperation.

Complications were categorized into 5 grades according to the modified Clavien–Dindo classification (Table 1).15 The complications were divided in minor and major complications. Clavien–Dindo degree 1 and 2 were defined as minor complications and degree 3 to 5 as major complication.

SURGICAL TECHNIQUE
All operations were done by 2 plastic surgeons specialized in postbariatric body contouring surgery. Both the surgeons used the same marking and operation technique.

Markings
The patient is marked in standing position as described in 2008 by Richter et al.4 First the markings of the back are made. The desired position of the scar is marked. The posterior upper incision line runs 2 to 3 fingers above this line. The inferior line of excision is estimated by strongly pinching the skin, while the patient bends slightly forward. Next, the anterior markings are made. This resembles the markings of an abdominoplasty with the incision lines continuing to the back. The lower incision line must be at 6 cm above the commissure. The dorsal inferior line and the anterior superior line should be checked during surgery and may be adjusted if necessary.4

General Preoperative Considerations
All operations were performed under general anesthesia and pre- and perioperative prophylactic antibiotics (cefazolin, 2 g preoperatively and 1 g repeated every 4 h during surgery).

Apart from preoperative low-molecular heparins, pneumatic intermittent compression devices were used for prophylaxis of thrombosis during the operation.

Surgery: Dorsal Contouring
With the patient in prone position, the incision is done according to the preoperative drawings along the superior mark down to the fascia of Scarpa. Next, the inferiorly based skin and fat flap are elevated over Scarpa’s fascia to the level of the inferior marks. The fascia is then transected shortly before reaching the inferior resection line and adhesions in the area of the lateral buttocks are released caudally until the gluteal fold. Then the section is continued to the lateral thigh below the superficial fascia.4

For autologous buttock augmentations, a few sutures can be used from the side to the middle of the buttocks and from caudal to cranial through the fascia for rearrangement of the fat. This reduces tension on skin closure and leads to sculpting of the buttock. During traction of the buttock flap in cranial direction, clamps are used to determine the extent of resection. Before closure the entire dorsal wound surface is sprayed with platelet-rich plasma to promote wound healing and angiogenesis.16,17 Two closed suction drains are left behind, 1 at each side. Closure of the wound is done by approximation of the superficial fascia, following closure in layers using resorbable sutures. The lateral dog-ear is temporary stapled for the process of turning the patient into the supine position.4

Surgery: Frontal Contouring
The frontal body contouring is performed as a “high lateral tension abdominoplasty.”18 The umbilicus is circumferentially incised and left in place. The lower abdominal incision is made down to the anterior rectus fascia and the abdominal flap is centrally elevated up to the level of the xiphoid. The more lateral undermining is carried out as limited as possible to preserve blood supply. In case of rectus diastases, plication is done in vertical direction.4

With the patient flexed at the waist, the amount of resection of excess tissue is assessed pulling the abdominal flap caudally. The new position of the umbilicus is marked...
Table 1. Clavien–Dindo Classification of Surgical Complications

| Degree | Definition |
|--------|------------|
| I      | Any deviation from the normal postoperative course without need of intervention beyond the administration of anti-emetics, antipyretics, analgesics, diuretics, electrolytes, and psychiatric therapy |
| II     | Complication requiring pharmacological treatment with other medicines beyond the ones used for complications of degree I |
| III-a  | Complications requiring surgical, endoscopic, or radiological intervention |
| III-b  | Intervention without general anesthesia |
| IV     | Life-threatening complication requiring admission to intensive care unit |
| IV-a   | Multiorgan dysfunction (including dialysis) |
| IV-b   | Multiorgan dysfunction |
| V      | Death |

*This degree also includes wound infections opened at the bedside.*

and incised, through which the umbilicus is pulled and sutured in. Again, 2 closed suction drains are left behind and a multilayer wound closure is performed after the wound surface is sprayed with platelet-rich plasma.\(^{16,17}\)

In case of excessive horizontal surplus, a fleur-de-lis method was performed. Furthermore, liposuction was done in case of excessive fullness in particular regions.

General Postoperative Considerations

The patient is placed in a beach-chair position wearing a compression garment around the lower body. Thrombosis prophylaxis is administered using low-molecular heparins. Compressing stockings are worn until mobilization. The patient is given an individualized patient controlled analgesia pump and is mobilized on the first day postoperatively. A laboratory test for hemoglobin is performed 1 day postoperatively. Drains were removed when producing less than 30 cc in a 24-hour period. After discharge, the compression garment was worn for 6 weeks, day and night.

STATISTICAL ANALYSES

Statistical analyses were performed using SPSS for windows (IBM SPSS statistics 21). Univariate logistic regression analyses were used to define odds ratios (ORs). Student’s t tests were used for parametric variables. Nominal variables were analyzed by Pearson’s chi-square test. A 2-sided P value ≤ 0.05 was considered statistically significant.

To assess possible differences of complications between the 2 surgeons and to evaluate the influence of a learning curve, we analyzed the complication rate between the surgeons and between the first and last procedures.

RESULTS

Patient Characteristics

A total of 101 patients underwent lower body lift surgery between January 2009 and January 2015 in the Catharina Hospital. One patient could not be included, because the operation file was missing.

The mean age was 43.6 years (23–64 y). Of the 100 patients (12 men and 88 women), 87 lost weight through bariatric surgery and 13 by lifestyle changes. Of these 87 patients, 42 patients underwent gastric bypass surgery, 26 patients underwent gastric sleeve surgery, and 19 patients had laparoscopic gastric banding as primary procedure. Because of the unsatisfactory results, 19 of these 20 laparoscopic gastric banding patients underwent a second procedure: 16 gastric bypass surgeries and 2 sleeves. Seven patients of the 26 sleeve patients underwent gastric bypass surgery as a secondary procedure.

The mean maximal weight was 337.1 lbs (229.3–604.1 lbs), with a mean maximal BMI of 52.9 kg/m\(^2\) (34.0–86.8 kg/m\(^2\)). The patients experienced a mean excess weight loss of 85.2% at a mean interval of 43.9 months (10–370 mo), resulting at the time of lower body surgery in a mean weight of 187.0 lbs (123.5–269.0 lbs) and a mean BMI of 29.3 kg/m\(^2\) (19.4–39.9 kg/m\(^2\)). They lost an average weight of 150.1 lbs (67.2–366.0 lbs) (Table 3).

Twenty-two patients were smokers, 17 patients had hypertension, and 7 patients were diabetic (Tables 2, 3). Fifty-two patients used nutritional supplements to optimize their nutritional state before operation.

Complications

The overall complication rate was 78%. Twenty-two percent of the patients had no complication. Complication grades according to the modified Clavien–Dindo classification were as follows: grade 1, 12.0%; grade 2, 44.0%; and grade 3, 22% (3a: 9% and 3b: 13%). No grade 4 and grade 5 complications were seen (Fig. 1).

Complications were divided into major and minor complications. Twenty-two percent were major complications (Clavien 3a and 3b) and 56% were minor complications (Clavien 1 and 2). Thirteen percent needed a surgical revision (Clavien 3b).

The most common complication was wound dehiscence, which occurred in 61 patients. The second and third most common complications were infection (44 patients) and seroma (32 patients). Other complications are listed in Table 4. Some patients had more than 1 complication (Table 5). From the 78 patients with a complication, 53 patients had 2 or more complications.

Risk Factor Analyses

Table 6 shows the results of the univariate analysis of development of complications after surgery. Table 7 shows the univariate analysis of development of histological complications (Clavien–Dindo grade >3) after surgery. BMI max (OR 1.08, P = 0.03), BMI pre-LBL (OR 1.17, P = 0.02), and percentage of excess weight loss (OR 0.97, P = 0.04) were significantly associated with the development of complications. Smoking increases the development of

Table 2. Comorbidities of Patients

| Comorbidity          | No. |
|----------------------|-----|
| Diabetes             | 7   |
| Hypertension         | 17  |
| Cardiovascular disease | 7  |
| Pulmonary disease    | 15  |

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complications with an OR of 7.74, \( P = 0.05 \). There were no variables significantly associated with the development of major complications (Table 7).

The patients were subdivided into categories based on BMI. There was a linear relationship between weight status and complication rate. A higher BMI pre-LBL, subdivided in three categories, is significantly associated with a higher complications rate (Fig. 2B).

**Surgical Technique Analysis**

There was no statistically significant difference in complications rate between the patient cohorts of each surgeon (Table 8).

To evaluate a learning curve over the 100 lower body lifts, we made an analysis among the first 50 lower body lifts and the last 50 lower body lifts. We found a slight, insignificant improvement in complication rate (Table 8).

Finally, we analyzed the influence of age in the development of complications. We operated on 16 patients older than 55 years, but there was no significant rise of complication rate in this group compared with the group of patients younger than 55 years.

**DISCUSSION**

Data available from the literature on lower body lift surgery and complications are limited.\(^7,8\) Complication rates vary from 50% to 70%.\(^7,8\) Other publications describe complication rates of surgical body contouring in general.\(^10–14,19\) Among these, complication rates vary from 27.9% to 42%. Compared with these, our complication rate of 78% is quite high. This can be explained by the fact that the definition of complications was different between studies. In our study, every wound dehiscence was scored as a complication. Other studies classified dehiscence as a complication, when the dehiscence was >1 cm in length or even of greater length.\(^7,14\) Furthermore, lower body lift surgery can be considered as an operation consisting of multiple procedures. Coon et al.\(^20\) described a significant higher minor complication rate in combined multiple-procedure cases than in single-procedure cases. This can be an explanation of the higher complication rate in our study compared with other studies describing complication rates in single-procedure cases.\(^9–14,19\)

This study is a retrospective analysis with its known shortcomings. The complications might have been reported and recorded less accurately and thus our complication rate might even be underestimated. Parameters such as hypothermia and malnutrition, which can be relevant for the development of complications, were not recorded in our study.\(^21\)

Wound dehiscence was the most common complication in our patient population, which occurred in 61% of the cases. This finding fits with prior literature.\(^7,8\)

Infection was the second most common complication with 44%, which is very high, compared with other stud-

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**Table 3. Patient Demographics and Clinical Characteristics**

|                        | All Patients (n = 100) | N   | Mean (Range) |
|------------------------|-----------------------|-----|--------------|
| Age                    |                       | 43.6 (23–64); SD 10.3 |
| Sex                    |                       | 88:12 |
| Weight loss            |                       | 52.9 (34.0–86.8); SD 9.3 |
| Method of weight loss   |                       | 152.9 (222.3–604.1); SD 32.3 |
| Pre-bariatric surgery   |                       | 23.6 (11.1–61.0); SD 8.6 |
| BMI max (kg/m²)        |                       | 85.2% (56.3–129.5); SD 14.8 |
| Weight max (lbs)       |                       | 150.1 (67.2–566.0); SD 26.5 |
| Weight loss            |                       | 187.0 (129.5–269.0); SD 13.7 |
| Excess weight loss (%) |                       | 5070.3 (1158–13,300); SD 2391.1 |
| Interval between bariatric and body contouring surgery (mo) |                       | 5070.3 (1158–13,300) |
| Duration of LBL operation (min) |               | 307.8 (197–438); SD 46.3 |

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**Fig. 1.** A, Complications divided in grades according to the modified Clavien–Dindo classification (there were no patients in Clavien IV and V). B, Complications subdivided in no complications, minor complications, and major complications.
Table 4. Complications in Patients Undergoing Lower Body Lift after Massive Weight Loss

| Complications       | No.  |
|---------------------|------|
| Wound dehiscence    | 61   |
| Infection           | 44   |
| Seroma              | 32   |
| Skin necrosis       | 13   |
| Hematoma            | 8    |
| Pulmonary embolism  | 1    |

Table 5. Number of Patients with an Infection, Necrosis, Hematoma, Seroma and Dehiscense Divided into Clavien–Dindo Grade

| Clavien–Dindo Grade | Infection | Necrosis | Hematoma | Seroma | Dehiscense |
|---------------------|-----------|----------|----------|--------|------------|
| 0                   | 56        | 87       | 92       | 68     | 39         |
| 1                   | 0         | 2        | 0        | 2      | 33         |
| 2                   | 32        | 7        | 5        | 25     | 20         |
| 3a                  | 5         | 1        | 0        | 3      | 2          |
| 3b                  | 7         | 3        | 3        | 2      | 6          |
| 4                   | 0         | 0        | 0        | 0      | 0          |
| 5                   | 0         | 0        | 0        | 0      | 0          |

Table 6. Factors Affecting Complication Development in All Cases (N = 100)*

| Study Variables       | OR    | 95% CI   | P    |
|-----------------------|-------|----------|------|
| BMI max               | 1.08  | (1.01–1.15) | 0.03 |
| BMI pre-LBL           | 1.17  | (1.02–1.33) | 0.02 |
| Percentage of excess weight loss | 0.97 | (0.94–1.00) | 0.04 |
| Weight reduction      | 1.01  | (0.99–1.03) | 0.29 |
| BMI ≥30               | 2.53  | (1.90–3.12) | 0.08 |
| Age                   | 1.03  | (0.98–1.08) | 0.30 |
| Weight of resected tissue | 1.01 | (0.99–1.03) | 0.35 |
| Tobacco use           | 7.74  | (0.98–61.16) | 0.06 |
| Hypertension          | 1.39  | (0.36–5.33) | 0.64 |
| Diabetes mellitus     | 0.34  | (0.07–1.65) | 0.28 |
| Lifestyle change vs surgical | 0.39 | (0.11–1.34) | 0.13 |
| Comorbidity           | 1.58  | (0.56–4.49) | 0.39 |
| Nutritional supplements | 1.11 | (0.43–2.86) | 0.83 |

*Univariate analysis for one or more complications.

Table 7. Factors Affecting Major Complication Development (N = 22)*

| Study Variables       | OR    | 95% CI   | P    |
|-----------------------|-------|----------|------|
| BMI max               | 1.01  | (0.96–1.06) | 0.76 |
| BMI pre-LBL           | 1.05  | (0.94–1.18) | 0.38 |
| Percentage of excess weight loss | 0.98 | (0.94–1.01) | 0.17 |
| Weight reduction      | 1.00  | (0.99–1.02) | 0.77 |
| BMI ≥30               | 1.73  | (0.67–4.47) | 0.26 |
| Age                   | 1.01  | (0.97–1.06) | 0.60 |
| Weight of resected tissue | 1.01 | (0.99–1.03) | 0.17 |
| Tobacco use           | 0.74  | (0.22–2.47) | 0.63 |
| Hypertension          | 0.42  | (0.09–2.00) | 0.28 |
| Diabetes mellitus     | 0.57  | (0.07–5.02) | 0.61 |
| Lifestyle change vs surgical | 0.61 | (0.13–2.98) | 0.54 |
| Comorbidity           | 1.08  | (0.40–2.89) | 0.88 |
| Nutritional supplements | 0.90 | (0.35–2.33) | 0.83 |

*Univariate analysis for one or more complications.

This could be explained by the definition of infection. In our study, all patients who used oral antibiotics postoperatively were considered to have an infection (Clavien 1). Furthermore, only 6 out of 44 had an infection as a solitary complication. In the other 38 patients, infection was in combination with other complications.

The third most common complication was seroma with 32%. Recent literature is highly variable as it comes to formation of seroma with 12.9% up to 37.5%. 7,10,12,14,19

Pulmonary embolism was diagnosed in 1 patient (1%) who was symptomatic and treated successfully. There were no cases of deep venous thrombosis. This is comparable with the outcome of other studies.7,8

The risk factors already known for post-lower body lift complications are age and BMI max.7,8,11 Our study parallels the finding of BMI max as a risk factor for post-operative complications, but not for age. Kitzinger et al7 reported a significant association between age at the time of lower body lift surgery and the development of complications. Therefore, Kitzinger et al decided to avoid performing lower body lifts on patients greater than 55 years of age. In our study, we did not find a relationship between the age of the patient and the development of complications. Furthermore, we found a linear relationship between BMI at the time of the lower body lift and complication rate, which parallels the findings of van der Beek et al.10 A higher BMI pre-LBL is a risk factor for post-operative complications. These findings are in contrast with Kitzinger et al,7 Nemerofsky et al,8 and Coon et al,11 where complication rates were not significantly associated with BMI pre-LBL.

The percentage of excess weight loss before lower body lift surgery is also a predictor for postoperative complications. The closer the patient is to the ideal weight, the lower the complication rate. This is in contrast with the results of Kitzinger et al,7 who only found a relation between formation of seroma and excess weight loss. Van der Beek et al10 also found excess weight loss to be highly significant as a predictor of complications.

Smokers had significantly higher complication rates in our study. Patients were preoperatively instructed to quit smoking, but a preoperative compliance control was not performed. These data depend on reliability of patients and their answers were highly subjective. Literature was variable in smoking and associated complications.7,8,10,22,23

Of the 100 patients in our study, 35 had at least 1 morbidity (hypertension, cardiovascular disease or diabetes mellitus, pulmonary disease), but none of these were predictors of complication rates.

All of our patients had a stable weight for at least 1 year before surgery. This is an important condition for health insurance coverage in the Netherlands. Van der Beek et al19 described the hypothesis that patients with a minimal stable weight of 3 months or longer before body contouring surgery have a better nutrition status. Bariatric surgery may induce nutritional deficits because of a reduced intake and malabsorption.13,24 In our study, 52 patients used nutritional supplements. The complication rate was not significantly related to the use of nutritional supplements.

The strength of our study, compared with other studies, is the relatively large population of 100 lower body lifts.7,8 Another strong point is the fact that only patients with lower body lift surgery are included, whereas other
studies frequently include different types of body contouring surgery.\textsuperscript{9–14} Kitzinger et al\textsuperscript{7} and Nemerofsky et al\textsuperscript{8} included patients with body lift surgery, but there are differences between the operation techniques used by the operators in these articles and ours.

Future studies should address larger sample sizes and long-term outcomes after lower body lift surgery. Furthermore, we will start a prospective database with documentation of comorbidities, nutritional state, patient satisfaction, surgical technique, and hypothermia during surgery.

Because of our significant complication rate in smokers, testing patients for preoperative smoking (cotinine urine test) can be considered.\textsuperscript{25} The surgeon must encourage abstinence of smoking for at least 6 to 8 weeks before intervention and make sure the patient fully understands the risks of smoking.

**CONCLUSIONS**

The lower body lift as described above is a good surgical solution to treat surplus and laxity of the skin after massive weight loss. The overall complication rate of 78% is quite high, even though 56% were minor complications and could be treated conservatively. Furthermore, BMI max, BMI pre-LBL, percentage of excess weight loss, and smoking are significantly associated with the development of complications. This study emphasizes the importance of good weight status before surgery and cessation of smoking to minimize the risk of complications. Careful preoperative planning and patient selection are essential to optimize the results of lower body lift surgery of post-bariatric patients.

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