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Classifying Severity of Abdominal Contour Deformities After Weight Loss to Aid in Patient Counseling: A Review of 1006 Cases

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Abstract

Background—Prior to massive weight loss (MWL), many patients wonder about their future abdominal contour. Abdominal contour deformities after MWL are highly variable, ranging from a mild upper protuberance to multiple rolls. Correction of these deformities is challenging and may require advanced surgical techniques. The incidence of patients presenting with various abdominal deformities and the factors influencing these deformities are not well defined, but could aid patients undergoing weight loss.

Methods—All MWL patients presenting for abdominal contouring from 2002–2012 were reviewed, and abdomens were graded using a modified Pittsburgh Rating Scale. Data collected for each patient included BMI indices, history of bariatric surgery, and type of abdominal contouring surgery.

Results—1006 patients were evaluated with a mean age of 44.2 years $\pm$ 10.5 years. The mean MaximumBMI was 51.7 kg/m² $\pm$ 9.6 kg/m², mean CurrentBMI was 30.0 kg/m² $\pm$ 6.4 kg/m², and mean DeltaBMI was 21.7 kg/m² $\pm$ 7.0 kg/m². 64% had a high-grade deformity. Patients with larger DeltaBMIs had higher deformity grades ($p < 0.001$). Patients with higher deformity grades were more likely to undergo a fleur-de-lis abdominoplasty ($p < 0.001$).

Conclusions—Most patients presenting for body contouring after MWL have high-grade abdominal deformities with multiple rolls. DeltaBMI is positively correlated with deformity grade

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and more aggressive abdominal contouring procedures. Patients interested in MWL should be counseled that, depending on desire for eventual outcomes, more complex procedures may be required to correct the resultant abdominal deformity.

Level of Evidence—Therapeutic, III.

INTRODUCTION

Body contouring after massive weight loss is a rapidly growing subspecialty of plastic surgery, as over 50,000 body contouring procedures are annually performed in post-bariatric weight loss patients.¹ Once the majority of these patients stabilize and shed greater than 50 percent of their excess weight, they are often left with loose skin and unexpected folds. In addition to contributing to the perception of an unattractive body, the excess skin results in physical symptoms such as pain and itching, mobility limitations, and hindrances in daily life. As a result, the desire for body contouring surgery among massive weight loss (MWL) patients is very high, with 75% of body contouring naïve patients requesting surgery at one or more body areas after weight loss.² Patient expectations of body contouring surgery include improved appearance, self-confidence, and quality of life.³ Body contouring has shown to be successful in these regards, as well as in improving the functional status of MWL patients.⁴

The abdomen is cited as the location with the most severe deformities after MWL.⁵ In addition to being the most severe, the deformities are highly variable. The simplest deformity is the traditional pannus of the lower abdomen, which may coexist with secondary or tertiary superior rolls that can be difficult to address. These multiple rolls can range in severity from a bulge of the anterior abdomen to an extensive double or triple roll that extends laterally to the back.⁶ Patients with substantial epigastric excess or multiple rolls present the most severe type of deformity.⁷ To correct these deformities, modified abdominoplasty procedures have been devised, including the fleur-de-lis operation and circumferential lower body lifts.^{8,9,10,11,12} These more complex abdominal operations are usually cosmetic in nature.

As patients begin to seek means of MWL, they often ask for a prediction about their future abdominal contour. Currently, a good answer to this question does not exist due to small studies of patients presenting for body contouring surgery without a clear evaluation of the types of abdominal wall deformities. To evaluate such deformities after MWL, a group from our institution established the Pittsburgh Rating Scale. This 4-point scale is based on region-specific grading criteria in areas of the body most frequently demonstrating laxity and ptosis following bariatric surgery, one of which is the abdomen.⁷ Although developed in 2005, the incidence of patients presenting with various abdominal deformities is still not well defined in the literature, and descriptions of the number and types of rolls are usually not reported. We aimed to evaluate the patient population presenting with abdominal deformities and to determine factors that may influence abdominal deformity.

METHODS

This study was an institutional review board-approved review of MWL patients with a greater than 50-pound weight loss from bariatric surgery or diet and exercise. Patients consisted of those who presented for consultation to the University of Pittsburgh Medical Center Life After Weight Loss Program for an abdominal contouring procedure between 2002 and 2012. Patients that were deemed surgical candidates underwent various abdominal contouring and concomitant procedures. Surgical technique was chosen based on pre-operative evaluation and discussion with the patient, taking into account deformity severity, predicted aesthetic result, post-surgical scars, and insurance coverage. The remaining patients did not undergo surgery, but were included in the study's analysis of non-surgical parameters. Demographic variables were analyzed for each patient, including BMI indices (MaximumBMI, CurrentBMI, and DeltaBMI (MaximumBMI – CurrentBMI)), weight loss method (surgical or self-weight loss), type of weight loss surgery (gastric bypass, gastric banding, or other), time from weight loss surgery to body contouring consultation and surgery, time from body contouring consultation to body contouring surgery, body contouring technique (standard abdominoplasty or fleur-de-lis), and concomitant procedures.

Preoperative photographs were viewed by a 3 member blinded panel consisting of 1 plastic surgeon and 2 researchers. Prior to the study, the panel underwent a training session where the members viewed photographic examples of each level of abdominal deformity. The established Pittsburgh Rating Scale for the abdomen was employed for Grades 0, 1, and 2: a Grade of 0 was indicated for appearance within normal range, 1 for moderate adiposity without overhang, and 2 for overhanging pannus. The Pittsburgh Rating Scale previously classified all multiple roll deformities as Grade 3. When evaluating our patient population, however, it became apparent that a more precise scale was needed to address the diversity of multiple rolls. The extent of the upper roll was decided upon as a factor that not only could easily be assessed based on pre-operative photographs, but one that also had clinical significance in making the traditional abdominoplasty procedure more difficult; therefore, depending upon if the upper roll was restricted to the panty-girdle line anteriorly, extended to the mid-axillary line, or extended to back, the deformity was given the Grade of 3a, 3b, or 3c, respectively. If triple rolls were observed, the deformity was given the Grade of 3d (Figure 1).

Statistical analysis was performed using SPSS Statistics, Version 21.0 (IBM Corp, 2012). Deformity grades were treated as continuous, linear values from 0 through 6 in order to compare the means. Pearson Correlation was used to determine if change in BMI correlated with deformity grade. Two-sample t tests were used to determine differences between patients with larger DeltaBMIs and higher deformity grades. Chi-squared tests were used to assess differences between categorical variables. All statistical tests were two-sided and significance was set to the level of $p < 0.05$.

RESULTS

Demographics, Body Contouring Technique, and Preoperative Deformity

One thousand and six massive weight loss patients were identified from 2002 through 2012. Of these patients, 916 (91.1%) were female, and 90 (8.9%) were male. Mean age was 44.2 years $\pm$ 10.5 years. The mean MaximumBMI was 51.7 kg/m² $\pm$ 9.6 kg/m², mean CurrentBMI was 30.0 kg/m² $\pm$ 6.4 kg/m², and mean DeltaBMI was 21.7 kg/m² $\pm$ 7.0 kg/m² (Table 1).

737 of the presenting patients underwent abdominal contouring surgery, of which 527 (71.5%) underwent traditional abdominoplasty and 210 (28.5%) underwent fleur-de-lis abdominoplasty. No patients had a Grade 0 deformity. 32 patients (3.2%) had a Grade 1 deformity, 330 (32.8%) had a Grade 2 deformity and 644 patients (64%) had a Grade 3 deformity with multiple rolls. Of the Grade 3 patients, 386 (38.4%) had Grade 3a, 104 (10.3%) had Grade 3b, 143 (14.2%) had Grade 3c, and 11 (1.1%) had Grade 3d (Figure 2).

Time to Body Contouring Consult and Surgery

The mean time to body contouring consultation after weight loss surgery was 2.4 years $\pm$ 2.6 years. The mean time to body contouring surgery after weight loss surgery was 2.7 years $\pm$ 2.4 years. Neither time to consultation ($p = 0.964$) nor time to surgery ($p = 0.635$) were related to deformity grade. The mean time to body contouring surgery after body contouring consultation was 4.9 months $\pm$ 8.3 months.

Degree of Deformity and Extent of Body Contouring Surgery

Patients with larger DeltaBMIs after MWL had significantly higher deformity grades ($p < 0.001$). In addition, patients with higher deformity grades were more likely to undergo fleur-de-lis abdominoplasty ($p < 0.001$). No significant difference existed in MaximumBMI prior to weight loss between the traditional and fleur-de-lis abdominoplasty groups ($p = 0.202$). Thus, patients with DeltaBMIs and higher deformity grades most often choose to add a vertical component to improve vertical and horizontal excess tissue (Table 2).

Of the 737 surgical patients, 346 (46.9%) underwent a concomitant contouring procedure. The most common additional procedure was a lower body lift ($n = 137$, 18.6%). In addition, 130 patients (17.6%) underwent mastopexy, 129 (17.5%) underwent brachioplasty, 96 (13%) underwent liposuction, 64 (8.7%) underwent breast reduction, and 17 (2.3%) underwent upper body lift. Deformity grade was significantly higher in patients who had a concomitant procedure ($p = 0.002$), and patients who underwent fleur-de-lis procedures were more likely to undergo concomitant procedures ($p < 0.001$).

Weight Loss Method

Eight hundred and sixty eight of the 1006 patients (86%) had prior bariatric surgery. The remaining patients achieved weight loss through lifestyle modifications. MaximumBMI did not differ between the bariatric and self-weight loss groups ($p = 0.544$). Of the patients with prior bariatric surgery, 841 (96.9%) underwent gastric bypass, 20 (2.3%) underwent gastric banding, and the remaining <1% underwent another bariatric procedure. When comparing gastric bypass and gastric banding, the type of procedure did not affect deformity grade ($p =$

0.501) or DeltaBMI ($p = 0.078$). History of bariatric surgery in general, however, was associated with a higher deformity grade and larger DeltaBMI ($p < 0.001$). In addition, history of bariatric surgery was associated with a higher incidence of fleur-de-lis abdominoplasty ($p < 0.001$) (Table 2).

DISCUSSION

As the rates of obesity continue to rise, more patients are seeking the health benefits of MWL. Prior to weight loss, they often desire to know what to expect for future abdominal contour. Post-weight loss, many of these patients find themselves plagued with the development of excess skin and abnormal body contour, specifically in the area of the abdomen.⁵ This skin is recognized as a displeasing consequence, resulting in dissatisfaction with personal appearance and significant desire to undergo body contouring procedures.¹³ Our study sought to identify and classify the types of deformities that MWL patients present with prior to body contouring. We set out to modify the existing Pittsburgh Rating Scale in order to account for more complex deformities. Finally, we evaluated different factors that are associated with larger changes in BMI and higher-grade deformities, with the hopes of being able to provide better counseling to patients both prior to and after MWL.

Our data showed that change in BMI is positively correlated with deformity grade. This can be used to counsel patients prior to weight loss, indicating that the more weight they lose, either through surgical or natural methods, the higher the chance of developing a more severe deformity, with the possibility of multiple rolls. In addition, our study showed that patients with larger changes in BMI and higher deformity grades most often choose to add a vertical, cosmetic component to address excess tissue. It should be noted that the patients who choose to add a cosmetic component do not necessarily start with a higher BMI prior to weight loss. This information, therefore, is important for counseling all patients with a wide range of elevated BMIs.

In addition to undergoing more extensive abdominal procedures, patients with high deformity grades were more likely to receive concomitant body contouring procedures. This fact can be used during patient counseling, indicating that contouring procedures may be needed on multiple aspects of the body, specifically the thighs, breasts, and arms. In patients with high-grade deformities, a lower body lift may help to distribute upper abdominal tissue without the need for a fleur-de-lis. Determining whether a patient is best suited for adding a lower body lift versus a fleur-de-lis is a complex decision process to which there is no correct answer. It is dependent on a multitude of factors including personal desires, expectations for recovery time, and financial obligations. Despite this, these decisions clearly influence the number and types of procedures performed and bias our results. In addition to the lower body lift, other procedures such as a mastopexy or upper body lift can aid in addressing upper rolls of the abdomen. In this study, almost half of the patients who underwent an abdominal contouring procedure had a concomitant procedure. High-grade deformities may need additional procedures to achieve ideal contours. Management of expectations is critical in patients with high-grade deformities, as patients who cannot afford or who are unwilling to consider additional procedures may develop residual deformities.

Over 85% of the patients presenting for an abdominal contouring procedure had a history of bariatric surgery. Bariatric patients had significantly greater changes in BMI than self-weight loss patients. This finding contradicts a study previously published from our institution, which found that self-weight loss patients were not significantly different from surgical patients in regards to BMI indices.¹⁴ Given that the our current sample size is approximately twice that of the prior study, it is possible that the number of patients previously analyzed was not large enough to observe a difference between the groups. In addition to the difference in DeltaBMI, patients who underwent bariatric surgery had more severe abdominal deformities upon body contouring presentation and were more likely to undergo extensive contouring procedures when compared to those who achieved weight loss through diet and exercise.

When comparing the types of bariatric surgery, our study found no significant difference between gastric bypass and gastric banding in regards to deformity grade, a relationship that has not been previously analyzed in the literature. This information is important to patients, as it indicates that both bypass and banding can result in high-grade deformities. Interestingly, although approaching significance ($p = 0.078$), our study did not find a statistical difference between type of bariatric procedure and DeltaBMI. This finding contradicts recent reviews in bariatric literature in which weight loss outcomes favor gastric bypass. Most of these studies, however, report a significant difference in weight loss outcomes at one year, with the differences narrowing overtime.¹⁵ Our study compared weight loss outcomes at an average of over two years after bariatric surgery, and therefore may be analyzing a time when the procedures are more comparable in outcomes. In addition, the small number of patients with a history of banding ($n=20$) compared to that of bypass ($n=841$) might have influenced our analysis.

In our study, the mean times from weight loss surgery to both body contouring consultation and surgery were over two years, suggesting that most patients were beyond the first year after bariatric surgery, in which weight loss is most rapid and BMI is most unstable. If patients presented early for consultation, specifically within the first year after bariatric surgery, their BMIs may not have been optimized and may have skewed our findings. In addition, the time from body contouring consultation to body contouring was approximately 5 months. The short duration between consultation and surgery suggests that most patients were good candidates for surgery at consultation and did not have to undergo more weight loss.

Prior studies have shown that socioeconomic factors play an important role in the decision to pursue body-contouring surgery after weight loss.¹⁶ This study did not consider socioeconomic status of the patient. More complete abdominal restorations, such as the fleur-de-lis, upper body lift, or lower body lift are not covered by insurance. Socioeconomic status, therefore, may influence the decision to pursue more advanced procedures. In addition, this study did not seek data on the number of bariatric surgeries performed from 2002 through 2012 and cannot make general conclusions for all bariatric surgery recipients. We do not know if our sample represents a large or small percentage of patients who underwent bariatric surgery, and if the deformities we observed have a similar distribution in patients who did not present for body contouring surgery. We also do not know if these

deformities were present before the weight loss, and thus may be the best predictor of deformities after weight loss. A longitudinal prospective study utilizing our grading scale from pre-weight loss to post-weight loss and post-body contouring would be helpful in further answering these questions.

The literature reports that patients often have misconceptions about post-bariatric surgery reconstruction, including patients being unaware of potential costs and the fact that reconstruction is not necessarily covered by insurance.¹⁷ These misconceptions, combined with our results, illustrate the need for better communication among bariatric surgeons, plastic surgeons, and patients. Prior to making decisions regarding bariatric surgery, patients should be educated about the severity and variability of abdominal skin excess that may result after MWL. Bariatric surgeons can use this study to inform patients of the types of deformities that most commonly develop and discuss factors that are associated with type of deformity, such as change in BMI and weight loss method. Patients should be educated about the different types of body contouring procedures prior to choosing bariatric surgery, emphasizing the extent of procedures that may be necessary to achieve desired results. In addition, discussions regarding scar anticipation and potential body contouring costs may become important factors in the decision to pursue bariatric surgery.

We expect to incorporate these findings into additional studies, in which we will further analyze patient expectations prior to bariatric surgery and develop a better system of educating patients about plastic surgery after weight loss. In order to improve continuity of care and education, the relationship between bariatric and plastic surgeons may need to become more symbiotic, similar to that of surgical oncologists and plastic surgeons for breast reconstruction. Such a relationship would be supported by patients, as over 70 percent of MWL patients expressed a desire to have plastic surgeons affiliated with their bariatric surgeons or teams.¹⁷ As comprehensive centers dedicated to post-bariatric surgery issues such as nutrition, fitness, and mental health already exist, integrating plastic surgeons into these centers may prove to be valuable.¹⁸ Such an environment could facilitate early education, as well as provide resources such as nutritional counseling, weight-loss monitoring, and financial planning assistance until the ideal time for plastic surgery is identified.¹⁹ Ultimately, this model will bridge the gap among bariatric surgeons, plastic surgeons, and patients, facilitating both important discussions about potential outcomes and the appropriate management of expectations.

CONCLUSIONS

Most patients presenting for body contouring after MWL have high-grade abdominal deformities with a double roll. Patients with larger changes in BMI and higher deformity grades most often choose to add a vertical abdominal component and concomitant contouring procedures to improve vertical and horizontal excess tissue. Depending on a patient's desire for eventual outcomes, more complex procedures may be required to correct the resultant abdominal deformity. These findings can aid plastic surgeons, bariatric surgeons, and patients in discussions regarding abdominal skin excess after MWL.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Modified Pittsburgh Rating Scale for Multiple Rolls of the Abdomen. A) Grade 3a: Double roll with small upper roll. B) Grade 3b: Double roll extending to mid-axillary line. C) Grade 3c: Double roll extending to the back. D) Grade 3d: Triple roll.

Figure 2.
Deformity grades of patients presenting for abdominal contouring surgery.