Plastic Surgery Improves Long-Term Weight Control after Bariatric Surgery

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Background: The positive impact of Roux-en-Y gastric bypass on weight, comorbidities, and health-related quality of life is well documented. However, 50 percent of patients regain some of the lost weight after 2 years with Roux-en-Y gastric bypass and present a mean weight regain of 10 to 15 percent after several years, partially losing the previously obtained benefits. The authors hypothesize that body contouring could decrease weight regain, leading to better long-term weight control after Roux-en-Y gastric bypass.

Methods: In a matched control study, variations in weight for 98 patients with body contouring after Roux-en-Y gastric bypass were compared with those of 102 matched control patients with Roux-en-Y gastric bypass alone. Data were collected prospectively at 1, 3, 6, 9, 12, and 18 months after Roux-en-Y gastric bypass and then yearly until 7 years.

Results: After a massive mean weight loss of 45.2 kg during the first 2 years after Roux-en-Y gastric bypass, patients with Roux-en-Y gastric bypass alone presented a higher continuous mean weight regain than those with Roux-en-Y gastric bypass and body contouring (1.78 kg/year versus 0.51 kg/year of weight regain, respectively; $p = 0.001$). After 7 years, patients with Roux-en-Y gastric bypass presented significantly higher mean weight regain than patients with Roux-en-Y gastric bypass and body contouring (i.e., 10.8 percent versus 3.6 percent mean weight gain, respectively; $p < 0.001$). Netting out mean skin excision weight of 2.04 kg by body contouring, the weight regain was 22.9 kg for patients with Roux-en-Y gastric bypass alone and only 6.2 kg for those with Roux-en-Y gastric bypass and body contouring.

Conclusions: The authors demonstrated that patients with body contouring present better long-term weight control after Roux-en-Y gastric bypass. Therefore, body contouring must be considered as a reconstructive operation in the treatment of morbid obesity. (*Plast. Reconstr. Surg.* 132: 826, 2013.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, III.

Most obese individuals suffer from impaired health-related quality of life and other forms of psychosocial distress.[1,2] A majority of them pursue obesity treatment seemingly for improvement in their physical image, their self-esteem, and their health-related quality of life rather than the loss of weight and related health improvement.[3,4] However, to the public health system and physicians, comorbidity control is the main goal of the treatment.

Presently, bariatric surgery, especially Roux-en-Y gastric bypass, has become the criterion standard treatment for morbid obesity,[5–10] with more than 100,000 operations performed each year in the United States alone.[11] Indeed, the procedure results in the best weight loss[12] and comorbidity improvement,[13–15] with the lowest complication rate in both the short term and the long term in comparison with other bariatric procedures (e.g., gastric banding) or nonsurgical treatment. Roux-en-Y gastric bypass also leads to a 30 to 40 percent decrease in mortality[16,17] and, moreover, improves health-related quality of life.[2,18–20]

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However, even though Roux-en-Y gastric bypass offers a fast, massive weight loss within the first 18 months after surgery, as many as 50 percent of patients may unfortunately regain some of the lost weight, with a mean weight regain of 5 to 10 percent within the first 18 to 36 months after surgery and 10 to 15 percent over the course of the next 10 years.[21] This weight regain can be associated with a recurrence of comorbidities, such as hypertension, diabetes, and hyperuricemia.[21–23]

Furthermore, more than two-thirds of patients who have undergone bariatric surgery consider the resulting excess skin to be a negative consequence of surgery.[24] This excess skin presents problems for the patient in their daily life and provokes important psychosocial disturbances[25] that could compromise the beneficial effects of the weight loss. This dissatisfaction motivates 74 percent of patients to seek body contouring procedures, but only 21 percent undergo at least one such procedure.[26]

The basic principle of body contouring is to tighten the cutaneous tissue to eliminate physical or psychological handicaps linked to the massive amount of excess skin. We demonstrated in a previous study that body contouring after Roux-en-Y gastric bypass improves health-related quality of life more than Roux-en-Y gastric bypass alone. This improvement was significant after body contouring in all evaluated domains of health-related quality of life: self-esteem, social life, work ability, physical activity, and sexual activity.[27]

Kalarchian et al. concluded that any interventions that improved the psychosocial functioning of a patient would also strengthen the weight loss maintenance.[28] Likewise, we hypothesize that body contouring, which improves health-related quality of life,[18,29,30] could also help patients to maintain previously obtained weight loss after Roux-en-Y gastric bypass.

In this study, we intended to evaluate the benefit of plastic surgery on body weight control. It is the first study that addresses the role of body contouring in maintaining a stable weight and decreasing the typical 10 to 15 percent weight regain following Roux-en-Y gastric bypass.[21,31]

PATIENTS AND METHODS

In the context of a multidisciplinary obesity program, from the beginning of use of Roux-en-Y gastric bypass in our General Surgery Department in 1997, a database was created. Demographic and personal data were collected from candidates for Roux-en-Y gastric bypass. Those who underwent Roux-en-Y gastric bypass were followed-up, and weight, body mass index, and excess body weight loss were collected during the follow-up appointments at 1, 3, 6, 9, 12, and 18 months after surgery and then each year after Roux-en-Y gastric bypass, and added to the database.

For this study, to assess the hypothetical benefit of body contouring on weight control after Roux-en-Y gastric bypass, two groups were formed from patients who underwent Roux-en-Y gastric bypass between 1997 and 2007 (n = 538). To reduce patients' insurance and economic status bias, in both groups, only patients who had public health insurance coverage, and for whom Roux-en-Y gastric bypass and body contouring were reimbursed by this insurance, were included. Then, the data from these groups were compared at each time point. The study protocol was reviewed and approved by the local clinical ethics committee.

Study Groups

Group A

Group A consisted of 98 patients with Roux-en-Y gastric bypass and body contouring. Among 538 patients who underwent Roux-en-Y gastric bypass, 136 had a body contouring procedure. All had undergone Roux-en-Y gastric bypass at least 18 months before plastic surgery and maintained a stable body weight through the prior 6 months. Ninety-eight consecutive patients (i.e., women, 89.8 percent; mean age, 42.6 years; range, 34 to 55 years) of those who had body contouring after Roux-en-Y gastric bypass with a complete follow-up for more than 2 years after body contouring were included in this group. The total weight of excised skin during body contouring was collected for each patient in group A.

Group B

Group B consisted of 102 patients with Roux-en-Y gastric bypass only. For each patient in group A, among 402 patients of the database who had undergone only Roux-en-Y gastric bypass, a matched patient was selected blindly by means of computer. The following criteria, in decreasing order of importance, were applied to find a matched patient in this group for each patient of group A: body mass index, excess body weight loss, sex, and age before and 2 years after Roux-en-Y gastric bypass. Four patients in group A had exactly the same selection criteria with two corresponding patients in group B; therefore, to reduce bias selection, both were included in this group. Therefore, 102 patients were included in this group (i.e., women, 89.1 percent; mean age,

38.6 years; range, 31 to 48 years). These patients had all demanded a plastic surgery consultation but had not undergone body contouring because they either had been turned down by plastic surgeons or, more frequently, their health insurance did not cover the cost.

Surgical Procedure

Bariatric Surgery

After a multidisciplinary consultation, a fully standardized Roux-en-Y gastric bypass (i.e., gastric pouch, ≤30 ml; alimentary loop, 150 cm; biliopancreatic loop, 50 cm) was performed on morbidly obese patients (i.e., body mass index > 40 kg/m^2) by general surgeons in our surgical department. These operations were performed by means of laparotomy until 2001 and by means of laparoscopy thereafter.

Plastic Surgery

Group A patients underwent the following procedures: abdominoplasty, 97 percent (with incisional hernia repair in 47 percent); mammaplasty, 32 percent (i.e., mastopexy alone, 51 percent; breast reduction, 33 percent; and breast augmentation with or without breast lift, 16 percent); cruroplasty, 19 percent; and brachioplasty, 14 percent. Moreover, 45 percent of patients underwent combined procedures through one or several operations.

Statistical Analysis

Patient characteristics were described as the mean ± SD or by percentages. The weight, body mass index, and excess body weight loss of group A were compared with those of group B by means of a *t* test for paired data as the patients were matched.

The change in weight, body mass index, and excess body weight loss decreased significantly more after Roux-en-Y gastric bypass was analyzed with a mixed linear regression model adjusted for age and sex (i.e., a random effect was introduced in an effort to account for the repeated measures). The group and the time were used as predictors in the model, and an interaction term was added to test whether the change over time was different in both groups. The goodness-of-fit was checked by plotting residuals (not shown).

The percentage of patients who achieved greater than or equal to 50 percent of excess body weight loss was assessed at various times, and the 95 percent confidence intervals were obtained using the exact method of Clopper-Pearson. The statistical analyses were performed using S-Plus version 8.0 software for Windows (Tibco Software, Inc., Palo Alto, Calif.), and the significance level was set at 5 percent.

RESULTS

Roux-en-Y Gastric Bypass Induces Fast Massive Weight Loss in the First 18 Months

Before Roux-en-Y gastric bypass, patients presented with a mean body mass index of 46 kg/m^2 (range, 41 to 48 kg/m^2) and a mean weight of 125 kg (range, 109 to 140 kg). Roux-en-Y gastric bypass alone resulted in an initial massive mean weight loss of 45.2 kg. Then, the patients reached a plateau approximately 12 to 18 months after surgery, thereby allowing them to obtain a minimal mean weight of 78.3 kg (range, 65 to 92 kg), a mean excess body weight loss of 68.4 percent (range, 58.2 to 80.7 percent), and a mean body mass index of 29.9 (range, 26 to 34 kg/m^2) ($p < 0.001$) (Fig. 1). During this period, 88.32 percent of the patients achieved greater than 50 percent excess body weight loss (i.e., 87.67 percent in group A and 88.52 percent in group B; $p > 0.05$). Similar kinetics of weight loss were observed in both groups, with nonsignificant differences between groups A and B up to 2 years after Roux-en-Y gastric bypass ($p > 0.05$), just before the mean time point when body contouring was achieved (Table 1).

Secondary Weight Regain after Roux-en-Y Gastric Bypass Is Prevented by Body Contouring Surgery

In group A, body contouring was performed within 2 years on average after Roux-en-Y gastric bypass. At the time just before body contouring in group A and at the matched time in group B, the weight lost, body mass index, and excess body weight lost were similar for both groups.

Total mean weight of excised skin by body contouring procedure in group A was 2.04 kg (range, 0.45 to 6.3 kg). Beyond the second year after Roux-en-Y gastric bypass, patients without body contouring (group B) started to regain significant weight. The weight differences between groups gradually became more significant over time. The yearly weight and body mass index increase was significantly more important in group B than in group A: 1.78 kg/year versus 0.51 kg/year ($p = 0.001$) of weight regain and 0.60 kg/m^2/year versus 0.16 kg/m^2/year ($p = 0.006$) of body mass index increase, respectively. The excess body weight loss decrease was also significantly higher

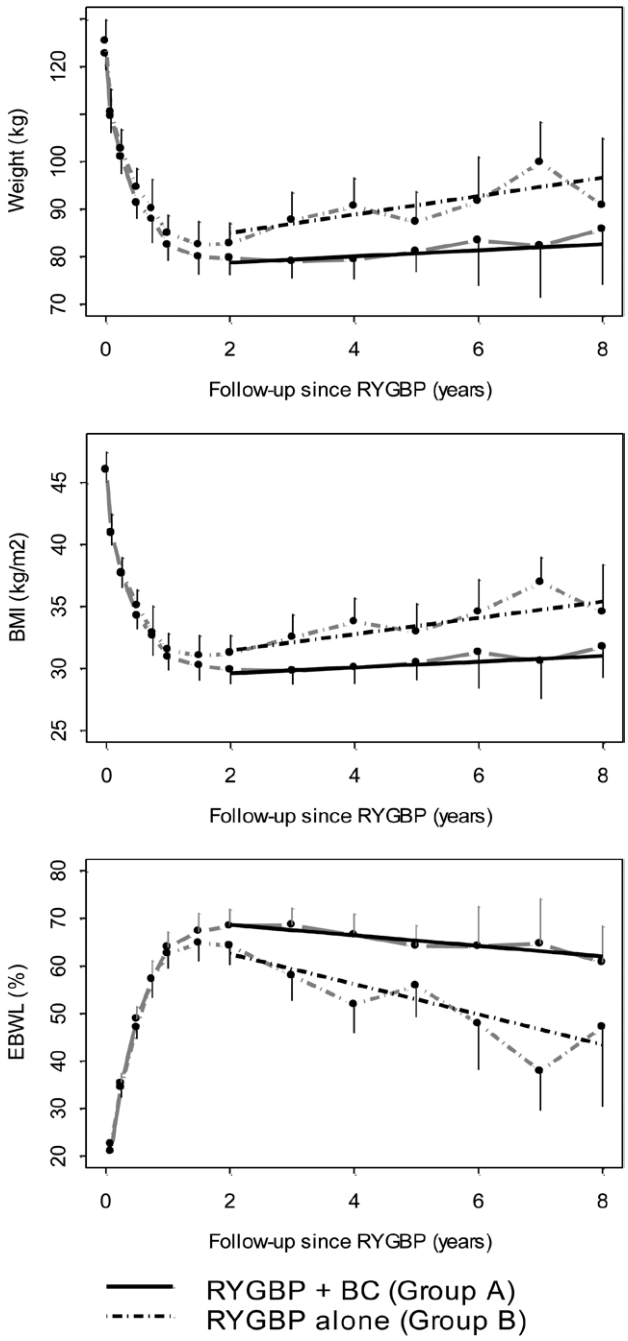

Fig. 1. Comparison of weight, body mass index (*BMI*), and excess body weight loss (*EBWL*) between group A and matched group B; The *line* indicates the mixed linear regression model adjusted to age and sex 2 to 7 years after Roux-en-Y gastric bypass (*RYGBP*).

in group B compared with group A (i.e., $p < 0.001$ for −2.91 percent/year versus −0.86 percent/year, respectively) (Fig. 1).

From the minimum weight achieved by Roux-en-Y gastric bypass, the mean weight regain at 7 years after Roux-en-Y gastric bypass was 3.6 percent of pre–Roux-en-Y gastric bypass weight (range, 0 to 6.34 percent) in group A and 10.8 percent (range, 7.4 to 20 percent) in group B ($p < 0.001$). This resulted in a higher final weight in group B as compared with that of group A (i.e., 101.2 kg versus 82.5 kg, respectively; $p = 0.01$). Even considering some weight lost because of skin excision in group A, the difference between these groups remained significant. Netting out skin excision weight, patients in group A gained only 4.8 kg during the 5-year period between 2 and 7 years after Roux-en-Y gastric bypass. whereas patients with Roux-en-Y gastric bypass alone regained 20.1 kg during this time. The mean body mass index increased significantly more in group B than in group A [i.e., 3.2 percent (range, 0 to 21 percent) versus 16 percent (range, 8.7 to 22 percent), respectively; $p < 0.001$] to achieve a body mass index of 37.2 and 30.6 kg/m^2, respectively.

At 7 years after Roux-en-Y gastric bypass, 58 percent of patients in group B and 25 percent of those in group A presented with at least a 10 percent weight regain. The mean excess body weight loss was 67 percent in group A and 38.5 percent in group B. Therefore, 75 percent of patients from group A had maintained greater than or equal to 50 percent excess body weight loss, in comparison with only 29.2 percent in group B (Table 2).

The multivariate models also indicated a significant gender effect in both groups: at 7 years after Roux-en-Y gastric bypass, men had a higher weight regain [i.e., 25.1 kg of weight regain ($p < 0.001$) and 3.3 kg/m^2 of body mass index elevation] and a lower excess body weight loss (−12.4 percent; $p < 0.001$) than women. Age was not significantly associated with weight ($p = 0.20$) or body mass index ($p = 0.10$), but the excess body weight loss decreased with age (−0.25 percent/year; $p = 0.04$).

DISCUSSION

Body image dissatisfaction, low self-esteem, and reduced health-related quality of life motivate many behaviors among obese people, including participation in diet programs and cosmetic surgery.[32] For patients seeking bariatric surgery, health-related quality of life is very important too. In 66 percent of cases, psychosocial impairment is the main motivation for their desire to have bariatric surgery; in contrast, only 10 percent of patients indicate a medically motivated desire for bariatric surgery.[33]

Unfortunately, because of excess skin that appears after the quick, massive surgical weight loss, patients' health-related quality of life

Table 1. Demographic and Data Comparison between Group A and Matched Group B

	Bypass and BC		Bypass Only		
	Value	IQR	Value	IQR	*p**
No. of patients	98		102		
Mean age ± SD, yr	42.6 ± 11.1	34–55	38.6 ± 10.1	31–48	NS
Women	88 (89.8%)		91 (89.1%)		NS
Before RYGBP					
Mean BMI ± SD, kg/m^2	46.0 ± 5.1	42–48	46.1 ± 7.7	41–48	NS
Mean weight ± SD, kg	124.6 ± 17.5	110–137	125.3 ± 24	109–140	NS
2 yr after RYGBP					
Mean BMI ± SD, kg/m^2	29.9 ± 5.1	26–34	30.3 ± 6.6	27–34	NS
Mean weight ± SD, kg	79.7 ± 15.9	68–90	81.1 ± 19.8	70–93	NS
Mean EBW ± SD, %	113.0 ± 23.5	94–126	112.5 ± 36.7	89–126	NS
Mean EBWL ± SD, %	68.4 ± 16.3	58.2–80.7	67.2 ± 17.7	56.8–79.2	NS

BC, body contouring; IQR, interquartile range; RYGBP, Roux-en-Y gastric bypass; NS, not significant; BMI, body mass index; EBW, excess body weight; EBWL, excess body weight loss.
*$p > 0.05$.

remains impaired after bariatric surgery. In fact, previous research indicates that 74 to 85 percent of patients want body contouring after Roux-en-Y gastric bypass,[26,34] but in most cases, body contouring is not covered by health insurance. Therefore, more than 80 percent of patients do not undergo this procedure because they cannot afford it (54.7 percent) or need to establish a payment plan (28.5 percent). Finally, only 12 to 21 percent of patients will undergo body contouring after massive surgical weight loss.[34] In our study, 32 percent of Roux-en-Y gastric bypass patients underwent body contouring as well (Fig. 2).

In many cases, insurance companies do not consider excess skin to be a disease, and body contouring is not viewed as a cost-effective treatment because, until now, no research had investigated whether patients who have undergone bariatric and plastic surgery experience a better long-term result in terms of weight. Our previous study demonstrated that body contouring after Roux-en-Y gastric bypass significantly improves health-related quality of life, specifically, self-esteem. Indeed, 85 percent of patients who have had Roux-en-Y gastric bypass and body contouring feel that their self-esteem is very improved as compared with only 48 percent of patients after Roux-en-Y gastric bypass alone. We believe that body contouring contributes to achieving the main goal for patients seeking bariatric surgery (i.e., a better quality of life). This improvement may therefore encourage patients to maintain a stable weight over the years. However, health-related quality-of-life improvement could also be explained by better weight control after body contouring. We have demonstrated that health-related quality-of-life improvement after Roux-en-Y gastric bypass is related directly to excess body weight loss (i.e., 97.8 percent of patients who had achieved >75 percent excess body weight loss estimated that their quality of life improved, but among those who had achieved <25 percent excess body weight loss, only 50 percent felt their quality of life improved).[27]

Previous studies have clearly demonstrated that Roux-en-Y gastric bypass per se appears to be a cost-effective intervention for moderately to severely obese people compared with nonsurgical approaches.[12,35] The surgical treatment decreases 45 percent of direct costs (e.g., the number of consultations, medical treatments, and hospitalizations) and also indirect costs (e.g., unemployment rate and sick leave) for morbidly obese patients who undergo bariatric surgery compared with the morbidly obese who do not have weight loss surgery.[36] The decrease in these costs is mainly related

Table 2. Percentage of Patients Presenting with Greater Than 50% Excess Body Weight Loss in Groups A and B over Time after Roux-en-Y Gastric Bypass*

EBWL ≥ 50%	1 Mo	3 Mo	6 Mo	9 Mo	12 Mo	18 Mo	2 Yr	3 Yr	4 Yr	5 Yr	6 Yr	7 Yr
Group A (RYGBP plus BC)	0	10.4	40.8	75.6	81.6	86.5	85.7	86.2	83.3	79.2	77.8	75
Group B (RYGBP)	0	5.1	35.7	67.4	82.8	87.1	78.7	68.3	54.8	56.2	44.4	29.2

EBWL, excess body weight loss; RYGBP, Roux-en-Y gastric bypass; BC, body contouring.
*Weight lost of more than 50 percent EBWL at more than 5 years after Roux-en-Y gastric bypass in more than 75 percent of patients has been defined as a criterion of an effective and successful Roux-en-Y gastric bypass (Baltasar A, Bou R, Bengochea M, et al. Duodenal switch: An effective therapy for morbid obesity. Intermediate results. *Obes Surg.* 2001;11:54–58). At 7 years after Roux-en-Y gastric bypass, 75 percent of patients from group A had maintained ≥50 percent EBWL in comparison with only 29.2 percent of patients in group B.

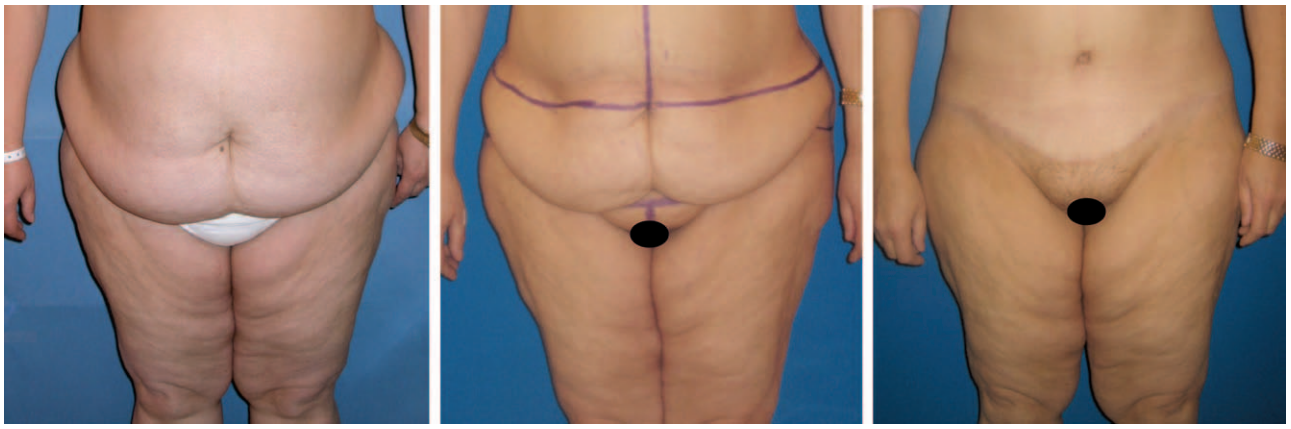

Fig. 2. Photographs of a patient before Roux-en-Y gastric bypass (weight, 116 kg; body mass index, 45.3 kg/m^2) (*left*), after Roux-en-Y gastric bypass (weight, 72 kg; body mass index, 28.5 kg/m^2) (*center*), and after body contouring (weight, 67.9 kg; body mass index, 26.5 kg/m^2) (*right*).

to a decrease in comorbidities, which is linked directly to weight loss. Previous research has concluded that even small weight changes (i.e., as little as 5 percent) can dramatically change comorbidities.[37] In this article, we demonstrated that patients with body contouring presented 18.8 percent less weight at 7 years after Roux-en-Y gastric bypass than those with only Roux-en-Y gastric bypass. Thus, it may be considered that plastic surgery prevents the secondary worsening of comorbidities and plays a role as a cost-effective treatment plan for obesity. However, as in the beginning of this prospective study, these endpoints have not been addressed directly; we cannot draw any conclusion concerning this hypothesis. Therefore, more clinical research focused on improvement of comorbidity and cost-effectiveness of plastic surgery are needed in the future.

Furthermore, as defined previously, among other criteria, an effective and successful Roux-en-Y gastric bypass should achieve more than 50 percent excess body weight loss that is maintained for at least 5 years in more than 75 percent of patients.[38] As we demonstrated (Table 2), these criteria are achieved mainly during the long-term follow-up period in patients who had body contouring after Roux-en-Y gastric bypass; indeed, those who had Roux-en-Y gastric bypass alone do not meet these criteria starting in the third year after surgery.

Even though this was a matched group study, some statistical bias limitations can still be identified. Indeed, a reasonable supposition suggests that patients who underwent plastic surgery had an initially stronger motivation and were more determined to control their body weight. Second, because some patients seeking body contouring were turned down by plastic surgeons or not covered by health insurance, a selection bias may be present between groups (i.e., wealthier patients have more access to body contouring surgery). Finally, it can be considered that body contouring procedures per se reduce the total body weight by removing some adipocutaneous tissue. However, this quantity was minimal (i.e., mean weight, 2.04 kg; range, 0.45 to 6.3 kg) and nonsignificant. Furthermore, as the weight changes become more obvious during long-term follow-up, this weight reduction could not by itself explain the continuous weight difference between these two groups, year after year. Even netting out the skin excision weight, the difference between the two groups remains significant and, essentially, the most important goal for patients and physicians is the final weight obtained. Weight improvement with body contouring could be attributable to excised skin partially, improved health-related quality of life, or other unknown mechanisms.

We demonstrated for the first time that patients who underwent body contouring after massive surgical weight loss presented better long-term weight control. Therefore, we suggest that body contouring should be encouraged by bariatric surgeons. As concluded by Warner et al., patients seeking bariatric surgery are insufficiently informed of the possibilities offered by plastic surgery after gastric bypass; indeed, only 7 percent of bariatric surgeons always refer their patients to a plastic surgeon, and only 33 percent refer patients occasionally.[39] Plastic surgeons should be included in the multidisciplinary team for bariatric surgery before Roux-en-Y gastric bypass to inform patients about the likely development of excess skin following this procedure and to discuss all of the

possibilities offered by plastic surgery thereafter. However, no excessive promises about the results should be made, and insurance conditions and restrictions should also be evoked.

CONCLUSIONS

With the increasing number of bariatric operations occurring today, the number of candidates for plastic surgery will certainly increase as well. However, in the absence of cost-effectiveness studies, insurance companies do not currently cover the costs of these operations provided that the excess skin does not achieve "a value of somatic or psychic disease." For the first time, our study demonstrates that patients who have undergone body contouring present significantly improved long-term body weight control after Roux-en-Y gastric bypass, in comparison with those without body contouring. This could suggest that body contouring after massive surgical weight loss may improve comorbidities that can relapse over the long-term period after Roux-en-Y gastric bypass alone. These improvements offered by body contouring are probably associated with a decrease in direct and indirect costs for morbidly obese patients, which is thus an important argument in favor of this type of treatment and coverage by health insurance. Indeed, in some cases, the treatment of the morbidly obese should not be considered successful as long as plastic surgery has not been performed. If we consider morbid obesity as a real disease, global care should be accepted by insurance companies. Because plastic surgery after massive weight loss is mandatory for improvement of health-related quality of life and weight loss maintenance in many patients, body contouring must be considered as a reconstructive operation for those who have achieved massive weight loss.

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