Improvements in Cardiovascular Risk Profile After Large-volume Lipoplasty: A 1-Year Follow-up Study

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**Background:** Large-volume lipoplasty changes body composition during a single surgical intervention by selectively decreasing subcutaneous adipose tissue. Positive health benefits, previously reported for a cohort of 14 women at 4 months after surgery, include significant decreases in weight, systolic blood pressure, and fasting insulin levels.

**Objective:** In the present study, we sought to determine whether the benefits of altering body composition by large-volume liposuction observed at 4 months are sustained over longer periods of time.

**Methods:** Subjects were seen for an additional follow-up visit approximately 1 year (range 10 to 21 months) after surgery. Fasting insulin levels were measured in the 8 patients who had preoperative fasting insulin levels higher than 12 µU/mL. Weight, systolic and diastolic blood pressure, heart rate, and body circumferences were measured in all 14 subjects.

**Results:** Compared with data obtained before surgery and 4 months after surgery, results at 10 to 21 months after lipoplasty showed that the improvements in body weight, systolic blood pressure, and fasting insulin levels observed 4 months after the procedure had been maintained.

**Conclusions:** Should these results be confirmed in larger studies, lipoplasty may prove to be a valuable tool for reducing some of the co-morbid conditions associated with obesity. (Aesthetic Surg J 2001;21:527-531.)

Large-volume lipoplasty (LVL), defined for this study as removal of 5 L or more of fat aspirate, has the ability to change body composition with a single surgical intervention. We have previously reported that this procedure can decrease body fat mass without significantly affecting lean body mass and leads to salutary metabolic alterations in overweight women (body mass index, [BMI] 25.1 to 29.9).1 We found that...
after subcutaneous adipose tissue was reduced by LVL, patients experienced significant decreases in weight, total body-fat mass, systolic blood pressure, and fasting insulin levels during 4 months of follow-up. Although many weight-loss studies have shown success at achieving short-term weight loss, far fewer have been able to show continued weight maintenance with concomitant improvements in the co-morbid conditions associated with obesity over longer periods of time.²,³ Therefore, we sought to determine whether the benefits of altering body composition by LVL observed at 4 months are sustained over a 1-year period after treatment.

Methods

Subjects were recruited by advertisements to participate in a study of the effects of lipoplasty. The study group consisted of 14 overweight but healthy (American Society of Anesthesiologists, class 1) premenopausal women with a mean BMI of 28.8 ± 2.3 kg/m², who agreed to use effective contraception for the duration of the study. Exclusion criteria included the presence of significant, unstable, or evolving diabetes or cardiac, renal, hepatic, gastrointestinal, or endocrine diseases; psychiatric/psychological syndromes; a current history of illicit substance abuse and/or alcoholism; and a recent use of anorexiant nutrient absorption. Each subject signed a consent form approved by the Georgetown University Medical Center Institutional Review Board. The details of the surgical procedure have been given elsewhere.¹ Briefly, patients underwent ultrasound-assisted lipoplasty of their backs, flanks, inner and outer thighs, and abdomen, with use of a superwet technique. Some also received lipoplasty of the knees, arms, and circumferential thighs. Separate operative consents were obtained for the use of tumescent and ultrasound-assisted lipoplasty.

The average lipoplasty infusion was 9052 mL (range 7050 to 11,750 mL), with a mean aspirate of 9406 mL (range 6600 to 14,090 mL). Fat aspirate was measured after at least 30 minutes of settling. The mean fat aspirate was 6733 mL (range 4675 to 8825 mL), with a total estimated surgical fat removal of 6.1 ± 1.2 kg (range 3.8 to 7.3 kg). These surgical fat-removal quantities may be somewhat overestimated because fat was not centrifuged before measurement.

Fasting plasma insulin, triglycerides, and cholesterol levels; body composition by dual energy x-ray absorptiometry; resting energy expenditure; and blood pressure were taken before and again after surgery, at 4 weeks, and at 4 months postoperatively and have been reported previously.¹ Subjects were seen for an additional follow-up visit approximately 1 year after surgery. Thirteen of the 14 patients returned for follow-up. The single patient who did not return for follow-up responded by phone for weight measurement. Fasting insulin levels were measured in the 8 patients who had preoperative fasting insulin levels higher than 12 µU/mL. Weight, systolic and diastolic blood pressure, heart rate, and body circumferences were measured in all patients.

Changes in body weight, BMI, blood pressure, and fasting insulin levels were studied with repeated-measures analysis of variance, followed by post-hoc t tests corrected with the Bonferroni-Holm procedure. A corrected P value of < .05 was considered significant. Nominal P values are reported. Mean ± SD are reported unless otherwise indicated.

Results

All 14 subjects returned for long-term follow-up examination at an average 13.8 ± 2.6 months (range 10 to 21 months) after LVL. At 1 year, total weight loss (compared with preoperative weight) was 7.4 kg, or 16 pounds (P < .00006). Body mass index decreased from 28.9 ± 2.3 to 26.3 ± 2.4 (P < .0003) (Figure 1, A, and Table 1). All of these reductions occurred in the first 4 months after LVL, and there were no significant changes in body weight or BMI between the 4-month and 1-year measurements. When examined individually, 12 of the 14 participants exhibited sustained weight loss, maintaining 85% to 200% of their surgical weight loss (weight in kilograms removed at the time of surgery) at 1 year. The remaining 2 patients maintained 1% to 10% of the surgical weight loss. Thus, at 1 year after surgery, approximately 85% of study subjects maintained or exceeded the weight loss of the adipose tissue calculated to have been removed at the time of surgery. When queried, no subject reported systematic attempts to increase physical activity or alter dietary intake.

The subset of 8 patients who had fasting insulin levels higher than 12 mIU/mL preoperatively (average insulin at study start 18.8 ± 6.1 mIU/mL) had significant reduction in insulin levels, at 6 weeks (13.6 ± 4.1 mIU/mL, P = .05), 4 months (7.1 ± 3.2 mIU/mL, P < .0006), and 1 year (10.1 ± 2.3 mIU/mL, P < .004) (Figure 1, B).
Systolic blood pressure was decreased at 1 year for all patients, from 132.1 ± 7.2 to 126.3 ± 9.2 (P = .02) (Figure 1, C, and Table 2). The subset of patients with elevated insulin levels showed nearly identical changes in blood pressure when analyzed separately. No significant changes were noted in heart rate or diastolic blood pressure at 1 year after surgery for total group or the subset with elevated insulin (Figure 1, D, and Table 2).

**Discussion**

One year after LVL, study subjects’ weight reductions, decrements in systolic blood pressure, and improved insulin levels were largely sustained. Approximately 85% of participants of this study exhibited sustained weight loss, maintaining 85% to 200% of their surgical weight loss (weight in kilograms removed at the time of surgery), even though subjects reported no significant change in exercise or diet habits. Of note, the surgical weight removed may have been overestimated by as much as 20%, because the fat aspirate was not centrifuged before measurement, thereby underestimating subjects’ subsequent weight loss.

Many studies suggest that the amount of intra-abdominal adipose tissue, rather than the quantity of subcutaneous adipose tissue, is more tightly linked to the complications of obesity. Although fasting glucose and insulin were the only measures available from this study to assess glucose homeostasis, the observed improvements in apparent insulin sensitivity are consistent with a role for subcutaneous adipose tissue in insulin resistance, possibly by being a source of circulating free fatty acids that might...
The effects of LVL on intra-abdominal adipose tissue in human beings and on more sophisticated measures of insulin sensitivity remain to be determined.

A recent pilot study suggests the possible deleterious effect of increasing the proportion of visceral adipose tissue following lipoplasty on men and women within their ideal body weight. The mean preoperative BMI for the women in this study was 22.2; for men, it was 26.3.

Programs that lead to sustained weight loss appear to reduce the health risks associated with obesity and can improve hypertension, hyperlipidemia, and insulin resistance. Because obesity accounts for approximately 5% of total direct health care costs, or $99 billion annually (based on 1995 data), and is the second leading cause of preventable death in the United States behind smoking, finding an effective weight-loss and maintenance method remains a primary concern for health care professionals.

With obesity currently on the rise in the United States, physicians need to establish successful long-term weight-loss programs for overweight and obese patients. Current weight-loss methods include diet, diet and exercise, behavior modification (changing inappropriate eating and activity habits), pharmacotherapy, and surgery. Although some persons do achieve long-term success, long-term weight maintenance for the majority of overweight persons remains an elusive goal, particularly after weight is lost by diet alone or diet and physical activity combined. The Food and Drug Administration–approved anti-obesity pharmacotherapeutic agents orlistat and sibutramine have been shown to be somewhat more effective for weight reduction and maintenance over a 1-year period than diet alone. Orlistat therapy also results in less weight regain during a second year of treatment. No other available anti-obesity medications have proven long-term efficacy. It is important to note that little is known about the long-term safety, cost-effectiveness of treatment, or sustained health benefits of either sibutramine or orlistat.

Behavior modification programs aim to make positive changes in the behavior and thinking patterns that affect weight. Many comprehensive, popular weight-loss programs, such as Jenny Craig and Weight Watchers, incorporate behavior modification into their plans. They can be efficacious when administered alone and also improve outcomes in adults when combined with other forms of obesity management, but they often induce relatively small weight changes.

Table 1. Comparative systolic and diastolic blood pressure (BP) changes before and after large-volume lipoplasty

<table>
<thead>
<tr>
<th>Time</th>
<th>Systolic BP (mm Hg)</th>
<th>P</th>
<th>Diastolic BP (mm Hg)</th>
<th>P</th>
</tr>
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<tbody>
<tr>
<td>Preoperative</td>
<td>132.1 ± 7.2</td>
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<td>82.9 ± 7.3</td>
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<tr>
<td>Postoperative</td>
<td>6 wk 121.8 ± 10.5</td>
<td>.003</td>
<td>76.9 ± 5.4</td>
<td>.06</td>
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<tr>
<td></td>
<td>4 mo 120.5 ± 7.8</td>
<td>.0002</td>
<td>77.2 ± 7.6</td>
<td>.06</td>
</tr>
<tr>
<td></td>
<td>1 y 126.3 ± 9.2</td>
<td>.02</td>
<td>78.8 ± 6.7</td>
<td>.4</td>
</tr>
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</table>

N = 13. No significant changes occurred in systolic or diastolic blood pressure between 4 mo and 1 y.

Table 2. Body mass index (BMI) and weight change before and after large-volume lipoplasty

<table>
<thead>
<tr>
<th>Time</th>
<th>BMI (kg/m²)</th>
<th>Mean weight loss (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
<td>28.9 ± 2.3</td>
<td>—</td>
</tr>
<tr>
<td>Postoperative</td>
<td>6 wk 27.3 ± 1.8</td>
<td>−5.1 ± 2.6, P &lt; .0001</td>
</tr>
<tr>
<td></td>
<td>4 mo 26.8 ± 1.5</td>
<td>−6.5 ± 3.3, P &lt; .00006</td>
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<td></td>
<td>1 y 26.3 ± 2.4</td>
<td>−7.4 ± 4.5, P &lt; .00006</td>
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N = 14. No significant changes occurred in body weight or BMI between 4 mo and 1 y.
Surgical treatments, such as gastric restrictive, malabsorptive, or combination procedures, have been successful at producing sustained weight loss for periods in excess of 1 year, yet because of their potential morbidity, these procedures are limited to patients who are severely obese (BMI > 40). It remains to be seen whether lipoplasty will emerge as another surgical weight-loss option that can be performed on patients who are less severely obese. Further studies of larger cohorts are required to verify the findings of this study with regard to weight maintenance and improvements of the co-morbid conditions associated with obesity.

**Conclusion**

We conclude that, in this small study of selected patients, weight reduction after LVL improved overweight women’s cardiovascular risk profile by decreasing body weight, systolic blood pressure, and fasting insulin levels over a 1-year period. Since improvements in body weight and obesity-related co-morbid conditions have been sustained for 1 year, we believe further studies should be carried out in larger populations to determine whether LVL should be considered part of the armamentarium to be used to induce weight reduction and reduce the co-morbid conditions associated with obesity.

**References**