AESTHETIC SURGERY After MASSIVE WEIGHT LOSS

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THE ROLE OF LARGE-VOLUME LIPOSUCTION AND OTHER ADJUNCTIVE PROCEDURES

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Key Points

Liposuction

• If the patient needs debulking of subcutaneous fat in several areas, including the trunk, large-volume liposuction (LVL) may be an appropriate first stage of body contouring, especially if LVL will improve the aesthetic outcome of later staged excisions. This most often applies to patients with a BMI higher than 30 kg/m².

• If the patient chooses a major excisional procedure first, such as a circumferential body lift (CBL), identify remote areas (e.g. upper back, arms, thighs, or neck) that will benefit most from liposuction during the same surgery.

• Liposuction is useful for refining contour or removing residual subcutaneous fat several months after excisional procedure wounds have healed.

• Know your vascular anatomy, and be extremely cautious if performing liposuction near an area that will be excised in the same surgery to prevent disruption of a flap’s vascular supply.

• If lipoplasty and an excisional procedure are performed during a single surgery, patient safety issues become more complex. Surgeons must be mindful of potential complications arising from both excision and liposuction and treat patients accordingly.

Mons reduction

• Improving the mons and genital area will improve function, hygiene, appearance, and patient satisfaction.

• Mons reduction can be safely combined with a CBL.

• Keep mons undermining to a minimum.

• Inform patients about temporarily decreased skin sensation, clitoral hypersensitivity in female patients, and prolonged edema and hypere mia following mons reduction.

Intergluteal reduction

• The skin length discrepancy and deforming effect of the posterior portion of a CBL can create a secondary deformity of the buttock. Intergluteal reduction or a V-shaped inverted dart incision in the intergluteal cleft helps minimize this deformity.

• The traditional posterior portion of a CBL incision is higher than is aesthetically ideal.

• To improve gluteal aesthetics, preserve the sacral triangle by lowering the central portion of the posterior body lift incision. Keep the incision at or below the level of the posterior iliac crest.

• Consult with patients about preferred underwear and bathing suit styles when designing incisions, but remind patients that fashion trends change. The goal of incision design should be the optimal aesthetic in the nude.

Autologous gluteal augmentation

• Thoracic spine/postural changes and anterior-inferior pelvic rotation associated with morbid obesity persist after massive weight loss and contribute to severe platypygia.

• The posterior component of a CBL causes flattening of the buttock.

• Autologous tissue of the lower back that would normally be discarded can be safely used to preserve or enhance projection in the gluteal region.

• Paucity of tissue overlying the coccyx and sacrum can be symptomatic, so preserving tissue in this area is important.

Axilloplasty

• Reducing the skin excess of the lateral chest wall/axilla can be safely combined with a brachioplasty, mastopexy or autologous breast augmentation, upper body lift, or CBL.

• Addressing this skin excess and recreating the lateral inframammary crease enhances the aesthetic results of breast procedures.

• Tissue that is normally discarded can be used for breast autoaugmentation as a well-perfused, well-described flap with known circulation.

• Preservation of critical axillary structures—including the brachial plexus, intercostobrachial nerve, lymphatics, and axillary fascia—will decrease morbidity.

Autologous breast augmentation

• The use of autologous axillary or lateral chest wall tissue to increase breast volume represents a good option for patients who do not want augmentation with an implant.

• Adding autologous tissue to the breast area provides increased volume and/or padding to prevent implant wrinkling and palpability if augmentation mammoplasty and/or mastopexy are planned.

• The normally discarded axillary tissue forms a lateral thoracoepigastric flap that is characterized by reliable perfusion and known anatomy.

• The use of the lateral thoracoepigastric flap is flexible enough to accommodate virtually all pedicle, skin excision, and breast pocket designs.
Liposuction plays an important role in body contouring of massive weight loss (MWL) patients and can be used to contour any body area that has excess fat. Suction-assisted (SAL), ultrasound-assisted (UAL), and power-assisted lipoplasty (PAL)—or their combination—are useful in the following contexts.

- Patients who need debulking of widespread subcutaneous fat prior to a staged excisional procedure.
- Patients who want or need additional contouring or removal of residual excess subcutaneous fat following an excisional procedure.
- Patients who have lipodystrophy in areas such as the upper back, thighs, or arms that may be improved with liposuction rather than excision.

Regardless of whether a patient has lost weight following gastric bypass surgery or through rigorous diet and exercise, weight loss will not be evenly distributed throughout all anatomical regions. Most patients lose visceral fat, which correlates with the reduction of their medical comorbidities, but significant subcutaneous fat may remain even after weight loss has stabilized. In most cases, areas of localized lipodystrophy are produced.

The volume of subcutaneous tissue plays an important role in the decision-making process when considering which procedures to undertake and in what order. As an example, loss of subcutaneous fat in the lower abdomen may be greater than in the upper abdomen. If a circumferential body lift (CBL) or panniculectomy is performed, patients may still have a large excess of subcutaneous fat in the epigastric region. Debulking this area with liposuction can simplify excisional procedures and produce a better aesthetic outcome. Liposuction is especially effective for removing excess fat in the back that is difficult to treat with a CBL. Another area that benefits from debulking prior to excision is the arms, which may retain significant excess fat even after patients have plateaued in their weight loss. If the arms are debulked with liposuction first, an excisional brachioplasty performed 3–6 months later—after the tissues have softened and vascularity has improved—will produce much better results. The thighs also benefit from debulking liposuction, as long as drains are used to prevent chronic seroma formation and infection.

For patients with significant subcutaneous volume, staged debulking liposuction can be safely performed before or after excisional procedures. For some patients, large-volume liposuction (LVL) as the first stage of body contouring may permit use of less extensive excisions or fewer staged procedures, as illustrated by the patient shown in Figure 12.1. The improvement in this patient's body contour would not have been possible without LVL, which prompted her weight loss. Limited liposuction combined with excisional procedures has been performed for years. Established combinations include:

- lower flank liposuction with abdominoplasty,
- submental liposuction with facialplasty,
- reduction mammaplasty with axillary lipoplasty, and
- CBL with thigh liposuction (Figure 12.2).

All these combinations share a focused use of liposuction based on known vascular anatomy and accumulated experience.

As the natural tendency toward innovation continues in plastic surgery, the literature increasingly reports on excisional procedures—such as abdominoplasty, thighplasty, and brachioplasty—combined in a single surgery with lipoplasty in areas that share a vascular supply. Proponents believe that liposuction performed on or adjacent to flaps allows smaller excisions and improves aesthetic outcomes. Reports published thus far are interesting and suggest that less flap undermining is required if liposuction and excision are combined. However, more safety data are needed before we know whether the risk associated with these combinations is acceptable, and Matarasso advises that extensive liposuction with a full abdominoplasty is ill advised. Patients must be properly informed about the potentially increased risks of delayed wound healing, infection, flap necrosis, or unfavorable scarring if excision and lipoplasty are combined. Above all, know your vascular anatomy before attempting to perform liposuction in or near an excision site. When in doubt, take a conservative approach rather than risk serious complications such as flap necrosis or delayed healing.

Issues of patient selection and informed consent have been covered elsewhere in this book. If liposuction is to be included in the body-contouring process, additional patient assessment must be done and consent obtained. By its nature, liposuction induces what may be considered blunt trauma injury. In addition, LVL may be associated with large fluid shifts that are dangerous—even fatal—if not handled appropriately. Patients should understand that they will have some excess skin and contour irregularities such as lumps, depressions, and wrinkles after LVL. The duration of recovery for LVL patients is approximately 3 weeks, but persistent swelling may last up to 6 months. Impressive skin retraction often occurs, especially after LVL, but final results will not be known for 3–6 months. Excision may be performed then if excessive skin laxity or contour irregularities remain.

### PREOPERATIVE PREPARATION

The length of surgery and health history of MWL patients demand that multiple factors be addressed during the month or so prior to surgery, regardless of whether the planned surgery is LVL alone or excision plus liposuction. Some guidelines follow.

- Obtain clearance from MWL patients’ internists or primary care physicians to ensure that they can safely undergo a large and lengthy operation. If patients do not have a physician, refer them to an internist.
- Pay special attention to cardiac health in patients undergoing LVL, because high-dose adrenaline (epinephrine) increases the risk for arrhythmias, fatal asystole, and myocardial infarction during surgery. Therefore hyperthyroidism, severe hypertension, cardiac
Figure 12.1 (a–c) This obese patient (BMI of 39 kg/m²) underwent large-volume debulking liposuction (LVL; 18,000 cc aspirate), which enabled her to begin a rigorous walking program of 3 miles six times a week. (d–f) Ten months after LVL, the degrees of skin retraction and back improvement are impressive. For this patient, LVL became an impetus to massive weight loss by reducing her large amount of subcutaneous fat. (g–i) Five months after abdominoplasty. The patient originally thought about having a circumferential body lift, but her posterior contour was so dramatically improved that she opted for an abdominoplasty instead.
disease, peripheral vascular disease, or pheochromocytoma are contraindications to lipoplasty.9

- Obtain a thorough health history, surgical history that includes all perioperative complications or problems, and complete list of current and recent medications plus herbal supplements. Ask specifically about birth control pills or hormone replacement therapy, because they increase the risk of thromboembolic events. Request medical records rather than rely solely on what patients say.

- Assess patients for scars from prior surgeries (gastric bypass, cholecystectomy, caesarean section, etc.) that predispose to skin necrosis following liposuction, especially if superficial liposuction is performed in a diabetic patient. If a patient is at risk, modify the procedure to be less aggressive adjacent to scars.

- Check for the wide range of electrolyte, vitamin, and nutritional problems that affect MWL patients,10 and optimize deficiencies at least 2 weeks prior to surgery. This

Figure 12.2 This 47-year-old patient had lost 130 lbs (59 kg) following gastric bypass surgery when she first came to us, and her BMI had gone from 69 to 46 kg/m². Multiple stages of body contouring were planned because of her high BMI. (a–c) Her first surgery consisted of a CBL, brachioplasty, and liposuction of the thighs, with 7.5 L aspirated from each thigh (total 15 L). Her second surgery included reduction mammoplasty and arm liposuction (total 7.7 L). (d–f) Postoperative views taken 6 months after the patient’s third surgery, which involved torsoplasty and secondary brachioplasty to further reduce skin excess and UAL of the lower back (5.3 L). The patient has continued to lose weight and her BMI is now 40. Her next planned procedure is additional liposuction of the thighs and an extended thighplasty. Although she has significant scars, the patient is pleased with her results.
may involve intensive vitamin supplementation, protein supplementation, and nutritional counseling for at least a month before surgery.

- Carefully evaluate hematologic parameters, because low hemoglobin levels are frequent among MWL patients. Some may require recombinant erythropoietin to raise the hematocrit before surgery, but this therapy carries an increased risk of hypercoagulability, requires intravenous iron therapy, and is costly.
- Type and cross-match patients in anticipation of the need for transfusion, a possibility that must be explained. Autologous blood donation should be discouraged, but directed donation by family members can be arranged.
- Arrange for smoking cessation counseling to prevent wound-healing problems in smokers. To measure compliance with smoking cessation, perform continue testing 2 weeks prior to surgery, on the morning of surgery, and 2 weeks after surgery. A positive test before surgery should result in delaying the procedure until the patient stops smoking.

Marking

Patients undergoing liposuction alone should be marked in the standing position before receiving any sedative medications. They may be marked in the preoperative area, but we prefer to mark patients who will have excisional procedures (with or without liposuction) a day or two before surgery. Marking with indelible markers is best done in an unhurried and private environment to enhance accuracy and improve the patient experience. Preoperative marking takes time if done properly, because it demands careful measurements and double-checking.

- Make bilateral markings as symmetric as possible, and note any preexisting asymmetries.
- Delineate prominent areas such as folds or bulges to be liposuctioned, because they will be less apparent when the patient lies down.
- Border areas where liposculpture feathering is anticipated should also be identified.

Using differently colored markers facilitates color coding and indicates areas to be treated differently.

Prophylactic measures 30–60 min before surgery

Hypothermia prophylaxis

Because procedures are lengthy and large body areas are exposed, body-contouring patients are highly susceptible to inadvertent hypothermia, which is defined as a core body temperature below 36°C. Hypothermia has been found to increase the incidence of postoperative wound infections and inhibit tissue oxygen delivery and coagulation functions, thereby raising the risk of bleeding-related complications. Begin warming the patient in the preoperative area with either heated cotton blankets or forced air blankets (such as a Bear Hugger) at least 30 min prior to surgery. Cotton blankets quickly lose their heat so must be continuously renewed. The objective of prewarming is to increase the heat content of the extremities so that heat will not be transferred out of the core during surgery.

Raise the operating room temperature to 73°F (23°C), which is the upper limit recommended by health-related government agencies. Infection risk increases when temperature rises above 73°F and humidity is outside the range of 30–60%. Intravenous fluids, as well as liposuction infiltration fluids, should be warmed between 37 and 42°C with a fluid warmer to help maintain normothermia. This includes the fluids begun in the preoperative area to replace deficits caused by overnight fasting. All fluids administered throughout the surgery and recovery room should be warmed. Do not heat fluids to temperatures higher than 42°C or burns may result. Warming the infiltration fluids is probably not necessary in UAL because the ultrasonic energy raises the temperature of tissues and fluids.

Thromboembolism prophylaxis

In 2004, the American College of Chest Physicians identified the following to be among the major risk factors for venous thromboembolic events (VTEs) such as deep vein thrombosis (DVT) and pulmonary embolism (PE): prolonged surgical time (more than 1 h), general anesthesia, patient age of 40 or more, and obesity. By these criteria, essentially all MWL patients undergoing body contouring have a moderate to high risk for VTEs. PE usually arises from DVT in the legs at or proximal to the popliteal veins, with above-knee DVTs most often being the culprit. The frequency of DVT is between 15 and 40% of general surgery patients if no prophylaxis is given, and 30–50% of patients with undiagnosed and untreated DVT progress to PE. Even when prophylactic measures are taken, the risk of DVT lasts for at least 4 weeks after surgery. Consequently, attention to VTE prevention must be a priority long after patients have gone home.

Mechanical prophylactic methods include compression stockings and intermittent pneumatic compression devices or venous foot pumps. Intermittent pneumatic compression devices or venous foot pumps are recommended for any plastic surgery procedure that lasts more than 1 h and for all patients undergoing general anesthesia. The use of intermittent pneumatic compression devices or venous foot pumps should begin approximately 30–60 min prior to surgery.

Anticoagulant therapy is the most effective method of DVT/PE prevention and the only real option for patients with a prior history of DVT/PE or a hypercoagulability disorder. Anticoagulant choices include:

- low-molecular-weight heparin (LMWH);
- low-dose unfractionated heparin; and
- the recently approved drug called fondaparinux (Arixtra), which specifically inhibits the activation of coagulation factor X.
Clinical trials suggest that fondaparinux may be twice as effective as LMWH in preventing postoperative DVT, and its use requires no routine coagulation monitoring. Adequate prophylaxis can be achieved by administering either LMWH or fondaparinux the morning after surgery, or at least 12 h following surgery completion. VTE prophylaxis should be continued until patients are fully ambulatory. For high- and very high-risk patients, continue chemoprophylaxis at home for 2 weeks, or longer if warranted by risk factors.

None of these anticoagulants has been found to increase clinically significant bleeding, and although postoperative hematomas are possible, they are uncommon. To help put bleeding risks in context, remember that acute adverse events occur in less than 1% of patients receiving transfusion versus the 15–40% of general surgery patients who develop DVT. Concerns about bleeding during liposuction are probably justified because sites of bleeding cannot be visualized and addressed, as is the case with excision. However, we have not had adverse bleeding in LVL patients given postoperative chemoprophylaxis.

Antibiotic prophylaxis

- For patients not allergic to penicillin, begin administration of 1 g of cefazolin (Ancef) 30 min before surgery.
- Patients with a penicillin allergy are given 500 mg of clindamycin intravenously infused over 1 h immediately prior to surgery.
- Diffucan should be given to patients with yeast infections.
- In cases that take longer than 6 h, repeat antibiotics during surgery.

Draping

Place forced warm air blankets beneath the patient on the operating table and also cover patient areas outside the operating field, such as the head and extremities. The key to draping is to allow easy access for infusion and aspiration of the wetting solution. Areas wider than those to be suctioned are exposed so that the area being contoured can be blended into the non-contoured area. Drapes should not distort the body contours with their weight. After completing work on an area (or two symmetric areas), redrape the patient to retain heat.

SURGICAL TECHNIQUE

Anesthesia

Large-volume liposuction (5000 cc of aspirate or greater) and other body-contouring procedures in MWL patients are best performed using general anesthesia with endotracheal intubation. Because these patients typically must be repositioned during surgery, intubation assures maintenance of the airway. In addition, patients are more comfortable, oxygenation is ensured, and monitoring can be done to detect any problems. When anesthesia is induced, a Foley catheter is inserted to aid with fluid monitoring. We advise a distal esophageal probe or tympanic membrane device for constant monitoring of core body temperature.

Oxygenation

Most anesthesiologists administer oxygen at an \( F_{O_2} \) of 30–50% during general anesthesia. However, a large randomized and blinded study of intraabdominal surgery patients found that an \( F_{O_2} \) of 80% during surgery and for 2 h afterward reduced the incidence of wound infections by more than half when compared with the use of 30% \( F_{O_2} \) (5.2% versus 11.2%). The use of 80% \( F_{O_2} \) may be especially important in lipoplasty patients who have received intentional vasocostriction by adrenaline (epinephrine). Another benefit of using 80% \( F_{O_2} \) is that the incidence of postoperative nausea and vomiting is markedly reduced (approximately 50%) when compared with 30% for \( F_{O_2} \).

Positioning

Position is dictated by the areas being treated with liposuction and same-surgery excisional procedures. The arms, flanks, back, hips, and outer thighs are most accessible to liposuction in the lateral decubitus position. The outer thigh offers a good example of the effect that supine or prone versus lateral position can have. In the supine or prone position, the weight of the body distorts the area and access is limited, in contrast to the lateral position that offers easy access and minimizes distortion. It is also much easier to evaluate results with inspection and palpation. The symmetry of areas can be assessed and refined in supine or prone positions. The abdomen, breasts, submental area, mons pubis, anterior and inner thigh, and knees are best treated in the supine position. When the patient is in a supine position, place a pillow under the knees to promote venous return flow through the popliteal area and thereby help prevent DVT.

Whatever position is chosen, it should allow easy access to the areas being treated and minimize the risk of distortion caused by position or pressure. A roll (folded/rolled linen) under the patient’s chest or pelvis under the patient’s chest or pelvis under the patient’s chest or pelvis under the patient’s chest or pelvis under the patient’s chest or pelvis under the patient’s chest or pelvis under the patient’s chest or pelvis under the patient’s chest or pelvis should be placed under the knees to promote venous return flow through the popliteal area and thereby help prevent DVT.

Fluid management

Fluid management is always a challenge in LVL because of the risks of hypovolemia or fluid overload. Consequently, patients undergoing LVL require a rigorous fluid management regimen. The superwet technique is recommended to keep fluid infiltration and aspiration as close as possible to a 1:1 ratio (1 mL in and 1 mL out). The tumescent technique relies on larger amounts of infiltrate, with ratios as high as 3:1 to 7:1, and is therefore more likely to cause fluid overload. When managing fluids, remember that approximately 70% of the infiltrated wetting solution is not aspirated but remains in the subcutaneous tissues until slowly absorbed into the intravascular space. Thus the majority of material in the aspirate is fat, not wetting solution.

Use a data sheet to record the actual measurements of the amounts of fluid going in and coming out. The ‘in’ half of the 1:1 ratio includes the subcutaneous infiltrate plus any supplemental fluids given intravenously. The ‘out’ consists of 30%
of the suctioned aspirate (the other 70% of infused fluid is not aspirated), blood loss, urine output, and drainage through drains. Subcutaneous infiltration solutions are usually mixed in 1- or 3-L plastic bags with graduated markers of volume. However, measuring by volume markers is very inaccurate. Instead, measure the weight (in grams) dispersed from the bag. When using the 1:1 ratio of infiltration and aspiration, the volume of replacement fluids should be reduced to avoid the danger of fluid overload. The suggested amount for LVL is 0.25 cc of crystalloid for each cc aspired over 5000 cc.16,19 This is in addition to crystalloid intravenous maintenance fluid administered at a rate of 1.5–2.0 cc/kg per h. The amount of maintenance and replacement fluids should be monitored and adjusted to vital signs and urine output.

Along with keeping meticulous records of fluid amounts going in and coming out, a patient’s heart rate, blood pressure, and urine output give important clues to the fluid status. The patient is hemodynamically stable if:

- the systolic blood pressure is over 100 mmHg,
- the heart rate is under 100 bpm, and
- the urine output is 0.5–1.0 cc/kg per h or greater.

Urine output is perhaps the best indicator of the need for supplemental fluids. The first sign of hypovolemia is usually tachycardia or a heart rate greater than 100 bpm. Young, healthy patients can often compensate by maintaining their blood pressure, but they tend to become tachycardic eventually.

**Blood loss**

During lipoplasty, the infiltrated wetting solution contains 1 cc of adrenaline (epinephrine) 1:1000 per liter of lactated Ringer’s solution (for a final concentration of 1:1 000 000 per liter) to achieve vasoconstriction. Before adrenaline became part of the liposuction wetting solution, the estimated blood loss was as high as 45%. Some studies have determined that blood loss represents about 1% of the aspirate when adrenaline is added.3,21 Karmo et al. compared hemoglobin levels before and 7 days after surgery, and found a mean decrease in hemoglobin (g/dL) of 0.93 ± 0.92 in SAL and 1 ± 0.64 in UAL for aspirate volumes up to 6000 mL. However, Cárdenas-Camarena and colleagues also evaluated the aspirate of patients undergoing LVL (5–22.3 L) and determined blood loss to be more in the range of 10% of the aspirate and higher after the seventh or eighth liter was aspirated.22 The mean reduction of hemoglobin 1 week after surgery was 3.8 g compared to presurgical levels.

Transfusion is always a possibility with LVL or liposuction combined with excision. The guidelines for blood transfusion are a hematocrit below 23% or symptoms such as orthostatic hypotension and tachycardia. Patients with coronary or central nervous system atherosclerosis should be treated more aggressively. Hematocrit can be easily checked during surgery to assess patient blood loss, but results may not be entirely reliable for several days, until hematocrit equilibrium is achieved following final resolution of fluid shifts.9,21 Healthy young individuals with normal preoperative hematocrits of approximately 40% can tolerate larger volumes of liposuction. Even though we have aspirated up to 34 L without giving transfusion to a morbidly obese patient, it is not uncommon to transfuse 2 units of packed red blood cells for aspirates over 20 L. Safety should be the first concern, and either the volume aspirated should be limited to an amount that maintains hemodynamic stability or transfusion should be available based on hematocrit and symptoms.

**Fluid infusion**

Surgeons should use the technologies and materials with which they are most comfortable. Neither LVL nor liposuction combined with excisional procedures should be attempted by the inexperienced because of the complex fluid management issues. Some general guidelines follow.

- Consider not including lidocaine when liposuction is performed under general anesthesia (as it usually is in MWL patients).
- Add 1 cc of adrenaline (epinephrine) (1:1000) for hemostasis per liter of Ringer’s lactate (for a final solution of 1:1 000 000).
- Warm infused fluids to a temperature between 37 and 42°C for SAL.
- Keep in mind the 1:1 infiltration to aspiration ratio when infiltrating wetting solution.
- Infuse wetting solution with a blunt needle that connects the wetting solution tubing and pump. Klein needles are available in numerous lengths and diameters to address a wide variety of areas treated.
- Use small puncture wounds for infusion to minimize fluid loss through the incision.
- Place incisions in locations that can be used for aspiration.
- Infiltrate the wetting solution in all fat layers until the area to be aspirated and the tissues at its periphery are uniformly turgid or firm to palpation.
- Use a pump and tubing capable of very high flow rates.
- Wait 12–15 min following infiltration before aspiration. Vasoconstriction from adrenaline (epinephrine) is sufficient when the skin appears blanched.
- Perform sequential infiltrations and aspirations rather than infusing wetting solution in all areas to be treated before aspiration begins. If multiple areas will be suctioned, you can usually start aspirating the first infused area as soon as the next area to be treated is infiltrated.
- Limit epinephrine dosing to 10 mg/3 hr period. This dose may be repeated after 3 hrs.23

**Application of ultrasound**

Ultrasound-assisted lipoplasty is especially effective for treating fibrous or dense areas such as the back, flanks, and upper abdomen, as well as areas that received previous liposuction. UAL is less appropriate for superficial sculpting and refinements. We avoid using it in curved body areas because the cannula or probe lacks the flexibility needed to follow curves. UAL is applied as an intermediate step between infiltration and aspiration, with the ultrasonic probe being turned on for a minute or two after infiltration to emulsify fat, which is then aspirated in the standard suction-assisted manner. The length
of ultrasound application varies by body area and patient, but ultrasonic energy sufficient to achieve fat emulsification has specific end points after which evacuation can be performed: a loss of tissue resistance to the probe and blood-tinged aspirate. When inserting the probe, place a skin protector and dry towel folded four times around the incision. Then keep the probe always moving to avoid dermal end hits and prevent thermal injury.

Because UAL emulsifies adipocytes—rather than destroying them with the mechanical avulsion of SAL—some believe that UAL is less likely to damage blood vessels and disrupt skin perfusion than SAL is, but this issue is far from settled. For example, some studies determined that skin perfusion is significantly better with UAL than with SAL, and wound healing is reportedly faster with UAL. Another analysis found no statistically significant difference in perforator vessel damage when comparing UAL and SAL.

Surgeons should use the liposuction technique with which they are most comfortable, including combined technologies. Fortunately, reports of skin burns and necrosis have decreased as surgical proficiency and UAL technology have improved. Nonetheless, the potential for catastrophic complications arising from a combination of UAL, PAL, or SAL with an excisional procedure still exists.

Aspiration
Large-volume liposuction is usually a debulking procedure, and relatively large cannulas (4-10 mm) can be employed. However, if cosmetic contouring in limited areas is being performed, smaller (2- to 4-mm cannulas) should be used. When large volumes are aspirated, speed is important. Studies have determined that the rate of aspiration is directly proportionate to cannula diameter, tubing diameter, and vacuum generated, and the rate of removal is inversely proportionate to cannula diameter and tubing length. Therefore, using a cannula and tubing with the largest diameter and shortest length produces the fastest aspiration. However, in fibrous areas, it may be easier to pass small-diameter cannulas. The cannula design and size depend on the areas treated, the type of liposuction, and physician preference. The tip configuration of the cannula has minimal effect on the rate of aspiration.

Leaving a layer of superficial fat to minimize the risk of contour deformities (such as wrinkles, dents, or lumps) is recommended by many, and this superficial layer may facilitate skin flap mobility at subsequent excisional procedures. However, the goal of LVL is to debulk the area. We have found that superficial SAL, carried all the way to the dermis, provides more complete debulking and better skin retraction in the abdomen, flanks, and back. In fact, some patients with a panniculus have sufficient skin retraction to make a subsequent excisional procedure unnecessary. Others who planned a CBL after liposuction had an abdominoplasty instead, because the large-volume debulking removed so much fat that the need for the larger incision and more difficult recovery of a body lift was obviated (Fig. 12.1).

For debulking aspiration, we begin with a 6-mm cannula and finish the superficial layer using a 6-mm beveled tip cannula with a single large opening that behaves like a curette even though its edges are not sharp. This cannula essentially vacuums off any fat globules attached to the skin or fascia, which minimizes contour irregularities and produces better skin retraction. Smaller cannulas (3-4 mm) are more appropriate for refinement in the arms, submental area, thighs, and hips, where a superficial layer of fat should be left to minimize contour deformities.

Drains
Seromas are common after LVL in the abdomen, flanks, back, arms, and thighs, especially when large-diameter cannulas are used. When treating these areas, insert #19 hubless Blake drains to minimize seroma formation and speed recovery. The drains are removed when output reaches 30-50 mL or less per 24 h.

Wound closure
Would closure can be done with any absorbable or non-absorbable suture and sealed with Dermabond dressings. We do not apply foam or compressive garments to the abdomen or thighs in the operating room because of concern about pressure injury and production of creases. When creases develop at the site of garment folds, they become relatively fixed and very difficult to eliminate. We apply TopiFoam to the submental area and cover it with an elastic head dressing. Arms also receive TopiFoam and are wrapped in Kerlix and Coban. Compression garments for comfort can optionally be used after drain removal.

OTHER ADJUNCTIVE SURGICAL PROCEDURES

In addition to body image disturbances, many MWL patients suffer from functional and hygienic issues caused by significant amounts of excess skin in the mons and genital area, buttock and anal region, and breasts and lateral thoracic wall. Along with skin excess, loss of tissue volume in some areas (face, breast, and buttock) produces significant contour deformities. During the past several years, we have noted increasing complaints regarding skin laxity in the facial region, upper abdomen, axilla, back, arms, and legs. Consequently, the adjunctive procedures described here have become more important for enhancing outcomes.

Deformities in these areas are not fully addressed by major body-contouring procedures. However, mons reduction, intergluteal reduction, autologous gluteal augmentation, axillo-plasty, and autologous breast augmentation can make a huge difference in the final contour appearance, as well as in hygiene and clothing fit, of MWL patients. These adjunctive techniques are ideally combined with other body-contouring surgery. The lower body procedures are well suited for combining with the CBL as the core rehabilitative procedure, and add 1-1 1/2 h to the operative time for all three surgeries.
An axilloplasty (~1 h) and breast autoaugmentation (2–3 h) work well when combined with upper body procedures. Alternatively, adjunctive surgery can be performed in separate stages of rehabilitation if combined procedures are not feasible. These smaller procedures are not metabolically demanding or lengthy, and may be done on an outpatient basis. When adjunctive procedures are combined together or performed in conjunction with a larger surgery such as a CBL or LVL, admission to the hospital for postoperative observation is advised.

**Mons reduction**
The suprapubic and genital regions are typically involved to a similar extent in MWL patients. Failure to contour these regions results in a suboptimal aesthetic outcome to the CBL, such as that seen in Figure 12.3, and decreased patient satisfaction, partly because problems with genital hygiene and function are not solved.

- In mild cases of suprapubic skin excess and lipodystrophy, standard liposuction of the mons will suffice.29
- In moderate cases of skin excess and lipodystrophy, excise an inverted triangular wedge of skin and tissue without undermining. Secure the superficial fascial system (SFS) of the mons to the anterior rectus fascia with ‘1’ Ethibond or Vicryl Plus to prevent excess superior displacement. Then close in layers with 3-0 Monocryl (Fig. 12.4).
- A deep tacking suture at the lateral aspects of the mons “triangle” helps to restore a more normal contour after mons reduction.

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Figure 12.3 Early in our experience with circumferential body lift, we did not understand the importance of mons reduction. This patient illustrates the deformity that can result if mons reduction is not performed in conjunction with a lower body lift.

Figure 12.4 Perform mons reduction before closing circumferential body lift incisions.
The most severe cases of skin and tissue excess involve both the suprapubic region and the labia in women (Fig. 12.5), while men tend to have invagination of the penis (Fig. 12.6). With severe deformities in women, the triangular wedge excision is extended to include labioplasty of the labia majora (Fig. 12.7). Although men benefit from the triangular excision, a repeat excision or further debulking liposuction at a secondary stage is usually necessary to correct the most severe male deformities. Patients should be counseled that prolonged edema and reactive hyperemia is typical for procedures in the genital region.

Differences of opinion remain regarding undermining of the mons. An alternative approach is to manually de-fat the deeper tissue layers of the superior mons when it is significantly thicker than the abdominal flap.

**Intergluteal reduction**

An aggressive CBL can produce several buttock deformities, including a flattened appearance, an accentuated length discrepancy between the superior and inferior skin flaps, and bunching of tissue at the intergluteal cleft (Fig. 12.8). An intergluteal reduction will resolve these problems (Figs 12.9 & 12.10).

1. Resect the skin and subcutaneous tissue to the presacral fascia and secure the SFS with #1 Vicryl Plus.
2. Close in layers with 3-0 Monocryl.
3. Seal the incision with Dermabond to reduce fecal contamination.

An alternative approach is to design the CBL incision with a V-shaped dart at the center of the back to prevent the intergluteal deformity. However, published descriptions of this incision tend to produce a scar that is too high to be aesthetically pleasing. A significant component of gluteal aesthetics is the presence of the sacral triangle, which disappears when a standard CBL incision with inverted dart is placed too high.
Not only is the sacral triangle disrupted, but the buttock appears longer. By lowering the incision into the gluteal cleft, the sacral and gluteal aesthetic units are preserved.31

1. Preoperatively mark this portion of the body lift incision with the patient standing but bent forward.
2. After the patient is anesthetized and in the prone position, lower both the superior and inferior extent of the marked incision an additional 1–2 cm. This keeps the amount of skin resection unchanged, so that postoperative skin tension is not increased but the aesthetic results are improved.

**Autologous gluteal augmentation**

We now typically combine autologous gluteal augmentation and an inverted dart incision with the CBL. This approach solves the problem with buttock deformities that result from a body lift, and the inverted dart incision preserves gluteal aesthetic units (Fig. 12.11). Markings for gluteal autonumentation and the CBL are done at the same time, unless this adjunctive procedure is performed separately.

1. With the patient standing, mark the level of the mons pubis on to each buttock to identify the point of maximum projection.
2. When the patient is placed on the operating room table in the prone position, outline one of the flaps shown in Figure 12.12, making sure the flap is centered over the points of maximum projection.
3. The superior and inferior markings for the posterior portion of the lower body lift can then be adjusted to accommodate the autologous tissue. This usually requires moving the CBL markings inferiorly by a few centimeters.
4. The safety and adequacy of the skin resection must be reconfirmed. If the flap cannot be positioned appropriately or the size is inadequate to achieve good projection, gluteal augmentation should be abandoned so as to not compromise the safety of the body lift.
5. Perfusion of the autologous flap can be confirmed with a Wood's lamp and fluorescein dye.

**Axilloplasty**

Many patients who seek upper body contouring complain about excess skin and adipose tissue in the axillary and chest area. This problem can be addressed with axilloplasty, which involves removing excess skin and fat from the axillary region. The procedure can be performed through a small incision in the axilla, allowing for minimal scarring and a natural appearance. Axilloplasty is particularly useful for patients with significant skin excess in the axillary region, as it provides a more natural and aesthetically pleasing result.
wall area lateral to the breast. For patients with mild skin and adipose excess in the axillary region, the best treatment is axilloplasty, which can be combined with other procedures, including mastopexy, autologous breast augmentation, brachioplasty, torsoplasty, and even CBL.

1. For marking, have the patient stand with arms fully abducted, then grasp the axillary skin excess and manually advance it in a superior-medial direction.
2. Mark the inferior point of greatest advancement (Fig. 12.14).
3. The superior marking is usually placed immediately posterior to the anterior axillary line or pectoralis border.
4. The inferior incision begins horizontally and abruptly curves superiorly to end in the axilla.
5. Preserve the axillary fascia and underlying neurovascular structures when the skin and subcutaneous tissues are resected.
6. Carefully secure the SFS to the axillary fascia prior to skin closure.

Autologous breast augmentation

The use of autologous tissue for breast augmentation can play an important role in body contouring for MWL patients because of their pronounced loss of breast tissue volume and moderate to severe skin excess. Breast recontouring typically involves restoring volume and reducing the skin envelope. The skin laxity and lack of tissue make augmentation with an implant especially challenging. Autologous augmentation represents a safe alternative that can be accomplished in one stage while simultaneously addressing surrounding deformities, as shown in Figure 12.15.

A variety of flap configurations are possible for breast autoaugmentation.

1. Mark the patient for a Passot “no vertical scar” mastopexy with the superior-lateral limb extended more vertically to reach immediately behind the anterior axillary fold (Fig. 12.16).
2. The inferior-lateral limb is extended into the axilla as it would be for an axilloplasty. This allows the lateral chest wall and axillary subcutaneous tissues to be utilized as a perforator flap. The flap can be based inferiomedially and left attached to the inferior pedicle or to the chest wall if a superior-medial pedicle is preferred.33–35
3. Pinch and manually advance the axillary skin to determine how much tissue is available for the flap.
4. After the markings are confirmed on the operating room table, deepithelialize the axillary skin and mark the flap with methylene blue.
5. Begin dissection distally and progress medially while preserving the superficial fascia of the lateral chest wall to protect the underlying neurovascular structures.
6. Rotate the flap superior-medially and inset with absorbable sutures to create a breast mound.
7. Secure the superficial fascia of the axillary skin to the superficial fascia of the chest wall.
8. Redrape the breast skin flaps and close in the usual fashion.
Figure 12.11 (a–c) This 28-year-old woman lost approximately 50 lbs (23 kg) through dieting, and her BMI went from 32 to 25 kg/m². (e–f) Five months following CBL and gluteal autoaugmentation with a moustache flap. The existing flatness of her buttocks would have been made worse with CBL alone, but the addition of the moustache flap produced good projection of the buttocks at the same level as the mons pubis, which is considered the ideal position. The inverted dart incision along with the autoaugmentation have greatly enhanced the gluteal aesthetic units.
Figure 12.12 Three flap configurations are possible for autologous gluteal augmentation. (a–d) Island flaps produce ‘normal' gluteal projection and are useful when the amount of presacral tissue is adequate. (e–i) A peanut flap is larger and produces mild augmentation. (j–n) The moustache flap provides the most tissue for gluteal augmentation.
Other adjunctive surgical procedures

Figure 12.13 Dissection of island or moustache flap. (a) After island flap dissection, the dermal islands are beveled away through the fascia, and the superior half of the flap is imbricated. (b) For a moustache flap, the lateral extensions are dissected to accommodate the size of flap appropriate for the patient. (c) The “handlebars” of the moustache flap have been rotated medially and imbricated to create an anatomical mound of gluteal tissue. After creating either gluteal flap, the posterior portion of the circumferential body lift is then dissected and the inferior flap pulled superiority to cover the new gluteal mounds.

Figure 12.14 Markings for axiloplasty show rotation of the flap used for autologous breast augmentation.
The role of large-volume liposuction and other adjunctive procedures

Figure 12.15  (a and b) Preoperative views of an MWL patient with a loss of breast volume and excess skin of the breasts, arms, and axilla. (c and d) Six months after autologous breast augmentation combined with axilloplasty and brachioplasty. Since this patient’s surgery with a Wise pattern mastopexy incision, we have adopted the Passot “no vertical scar” mastopexy technique. The Passot technique solves the problem of lateral displacement of the nipple-areolar complex seen in this patient.

Figure 12.16  Autologous breast augmentation simultaneously enhances volume of the breast while reducing excess skin of the axilla and lateral chest wall. This illustration shows incorporation of a lateral thoracopigastic flap for breast augmentation as well as torsoplasty. If torsoplasty is not performed, the vertical incision on the side of the torso will be much shorter.
Wound dressings

We no longer routinely use dressings on long incisions for several reasons. They impede the ability to monitor skin flaps and intervene in a timely manner should problems arise. Additionally, as edema increases over the first 1–3 days, a taped dressing becomes constrictive and can produce shearing forces that cause blistering. These blistered areas are then subject to postinflammatory hyperpigmentation, which is bothersome and long-lasting. To prevent this complication, we now use Dermabond in lieu of dressings. Dermabond ‘seals’ incisions and prevents bacterial contamination, permits observation of healing, and accommodates edema.

The posterior incision of a CBL, as well as intergluteal reduction and gluteal augmentation incisions, are vulnerable to another vexing problem: minor wound dehiscence. Flexed posture when the bed is in a semi-Fowler’s position and early postoperative edema seem to contribute to a higher rate of minor superficial posterior wound separations. This problem has been significantly reduced by adding a scant row of reinforcing staples to the posterior aspect of the incision after Dermabond has dried. These staples are removed at the first postoperative visit to reduce permanent ‘track’ marks on the skin.

OPTIMIZING OUTCOMES

Lipoplasty is an essential component of body contouring in MWL patients and can play a variety of roles, especially for debulking before excision and for refinement of results in a staged procedure following excision. In many instances, liposuction reduces the need for excision or minimizes excision size.

Aesthetic outcomes in MWL body contouring are in large part significantly related to BMI. Because better results are achievable in patients with a lower BMI, surgeons are wise to begin incorporating adjunctive techniques with lower BMI patients. As experience grows, adjunctive procedures can be added for patients with higher BMIs and more complex deformities.

The types of adjunctive procedures described here can dramatically improve the aesthetic results of body contouring and produce high levels of patient satisfaction.

Perioperative management is critical in body contouring. Proper fluid management must be carefully addressed in LVL. In addition to stressing the maintenance of normothermia, we have adopted more aggressive VTE prophylaxis because MWL patients are at increased risk for this dangerous and potentially fatal complication.

Counsel patients and family members about expected difficulty with routine daily living tasks after surgery, especially if combined procedures are performed. Patients may initially need assistance for transferring in and out of bed, taking care of hygiene, and following early ambulation guidelines. Equipment to help with such tasks can be rented at surgical supply stores. Disposable supplies such as adult diapers, moist wipes, anesthetic or antibiotic creams/ointment, and peroxide are also useful during the first days after discharge.

POSTOPERATIVE CARE

Massive weight loss patients, including those undergoing LVL, demand close postoperative scrutiny. They should be kept in a medical facility for at least one night to make sure that they have fluids carefully managed, are hemodynamically stable, and do not require transfusion. On average, our multiprocedure patients prefer 2–3 days of hospitalization. Guidelines for the immediate postoperative period follow.

- Continue forced air and fluid warming in the recovery room. Once on the floor, extra warming should not be necessary.
- Continue fluid resuscitation until oral intake is sufficient. The goal is to ensure adequate urine output, a systolic blood pressure greater than 100 mmHg, and a pulse rate below 100 per minute. This generally means 125–150 mL of crystalloid per hour. If hypovolemia is evident, treat with a crystalloid fluid challenge of 500 mL/h. Use diuretics to treat fluid overload, which is characterized by hypertension, jugular vein distension, full bounding pulse, cough, shortness of breath, or moist crackles on auscultation of the lungs. If not addressed, fluid overload may progress to pulmonary edema and congestive heart failure.
- Apply topical 70% dimethyl sulfoxide (DMSO) to improve tissue perfusion if ischemia is noted near incisions in the intraoperative or early postoperative period.36 DMSO should be reapplied every 4 h until circulation in the area improves. (This is an off-label use.)
- Start the diet with clear liquids and advance as tolerated, keeping in mind that many gastric bypass patients cannot tolerate high-sugar diets. Pay particular attention to protein intake in a suitable form. Close communication with the patient’s bariatric surgeon facilitates consultation if a general surgical issue should present.
- Check hematocrit and hemoglobin immediately postoperatively and at 12 and 24 h later to assess red blood cell loss. Many LVL and MWL patients will manifest an anemia with a hematocrit below 30%. In these cases, a fluid challenge of 500 mL/h may lower the pulse rate and raise blood pressure. Increasing the amount of crystalloid might produce further hemodilution. If a patient becomes tachycardic or develops orthostatic hypotension, transfusion may be necessary. Two units of packed red blood cells are required when the hematocrit is below 23%.
- Maintain patients on an $F_{O_2}$ of 80% through a ‘non-rebreather’ mask for the first 2 h after surgery to decrease the risk of infection, minimize nausea, and ensure optimal tissue oxygenation. Then switch to standard oxygen through a nasal cannula for 24 h.
- Continue prophylactic antibiotics for 24 h after the preoperative dose. No studies have determined that prophylactic antibiotics administered for more than 24 h after surgery are of any benefit, but they should be continued if infection is present.
• Continue DVT prophylaxis with intermittent pneumatic compression devices and stress early mobilization. Intermittent pneumatic compression devices should be removed and replaced after walking until the patient is discharged. Encourage patients to begin ambulation the day after surgery. If appropriate, continue anticoagulation prophylaxis with LMWH or fondaparinux for 1–4 weeks after surgery or until fully ambulatory.

• Manage pain with morphine or meperidine (Demerol) patient-controlled analgesia and/or oral narcotics as needed. Gradually wean patients to non-narcotic pain relievers. Some body-contouring patients report chronic pain after surgery that may result from nerve injury. Gabapentin (Neurontin) and/or amitriptyline (Elavil) are sometimes effective for treating the type of burning pain patients describe.

• Discontinue the Foley catheter early on the first postoperative day to encourage ambulation.

• Order a complete blood count and basic metabolic panel for the morning after surgery. Glucose monitoring may also be warranted. Common electrolyte abnormalities that follow LVL include lowered sodium, potassium, and blood urea nitrogen levels in the early postoperative period. Liver enzyme testing has revealed significantly lowered levels of albumin and protein that are consistent with hemodilution and lowered blood viscosity. In addition, levels of plasma aminotransferases significantly increased in LVL patients, a possible indication of injury to adipocytes or skeletal muscles or hepatocellular damage. Creatine kinase levels also may be elevated.

• Leave drains in place until output is in the range of 30–50 cc in 24 h. If drainage is prolonged, perform sclerosis with a high-concentration doxycycline solution (100 mg per 10 cc of 0.9% saline solution) infused through the drain. Prior to sclerosis, infuse with 0.5% marcaine for anesthesia. Clamp the drain for 15 min and then return to suction. Because the doxycycline concentration is higher than recommended for infusion, it must be specially ordered for off-label use. Infusion can sometimes be painful, and analogesics are recommended. Injection into a seroma cavity can be performed, but it must not be into the subcutaneous tissue because doxycycline can cause fat and skin necrosis.

• Occasional massage therapy is often useful to help speed the resolution of edema following liposuction.

• Compressive binders and garments should not be used routinely in the immediate postoperative period, because they may interfere with already-challenged perfusion of skin and/or flaps and impair the ability to monitor blood flow. Drains inadvertently placed beneath a binder can cause pressure necrosis. Later in the postoperative course, it may be prudent to add a compression garment to reduce swelling, dead space, and discomfort associated with ambulation.

### COMPLICATIONS AND THEIR MANAGEMENT

#### Liposuction

Recent statistics place the rate of significant complications secondary to lipoplasty in the range of 0.3% to 1.8%. Major complications include:

- hemorrhage (usually resulting from visceral perforation),
- hematoma (particularly in the retroperitoneal space if the fascia is penetrated),
- skin or fat necrosis (major) or skin slough,
- infection,
- necrotizing fasciitis,
- pulmonary edema (resulting from fluid overload),
- lidocaine toxicity,
- DVT,
- PE,
- fat embolus,
- cardiac arrhythmia, and
- death.

Minor complications are:

- contour irregularities,
- scarring,
- prolonged edema,
- paresthesias,
- anemia,
- hypovolemia,
- hemodilution that requires blood transfusion, and
- thermal injury from ultrasonic energy.

Seroma is perhaps the most common complication of liposuction, but its frequency can be greatly reduced with drains. There is no evidence of increased complication rates when aspirate volumes of ≥5000 cc are compared with volumes <5000 cc. Massive weight loss patients who undergo debulking liposuction with or without excisional procedures have the potential to develop the typical complications of liposuction plus some additional risks. Contour irregularities such as wrinkles, lumps, or dents occur in almost all MWL patients, but they are generally tolerant of such irregularities if the possibility has been discussed preoperatively. If excessive skin laxity remains after liposuction—and it usually does—staged excisional procedures are the only option for correction. Some patients, however, accept the skin excess if the fat debulking is sufficient to make them more physically comfortable.

The risk of lidocaine toxicity becomes real if the total delivered dose exceeds 35 mg/kg. Lidocaine toxicity can be completely avoided by omitting it from the infusion solution. Kenkel and colleagues determined that only about 10% of infiltrated lidocaine is aspirated, and lidocaine toxicity may not manifest for 8–16 h after surgery. The time to peak for the lidocaine metabolite monoethylglycinexylidide may be even longer, up to 28 h. (Because lidocaine is metabolized in the liver, it should not be used in patients with liver dysfunction.) Therefore the period of potential lidocaine toxicity lasts longer than is commonly believed. However, the analgesic effect of lidocaine is not long-lasting. Kenkel et al. found that even
though lidocaine is present in blood for up to 18 h, it does not remain at a therapeutic dose in local tissues for more than 4–8 h. Most surgeries performed in MWL patients require general anesthesia because procedures are lengthy and rigorous monitoring is essential. Patients receiving LVL or liposuction plus excision are going to require opiate analgesia postoperatively, as well as hospitalization. Therefore the need for lidocaine is non-existent in these patients.

Fat embolism has been reported with liposuction, although its frequency is unknown. Estimates place this complication in the range of 1:100 000 to 1:300 000. Fat embolization occurs when small globules of fat migrate through the venous circulation to the lungs. It usually does not produce significant symptoms unless there is a large amount of embolization, but symptoms may include tachycardia, tachypnea, elevated temperature, hypoxemia, hypocapnia, or thrombocytopenia. In contrast, fat embolism syndrome is an inflammatory and biochemical condition associated with free fatty acids released when small globules of fat migrate through the venous circulation to the lungs. It usually does not produce significant symptoms unless there is a large amount of embolization, but symptoms may include tachycardia, tachypnea, elevated temperature, hypoxemia, hypocapnia, or thrombocytopenia. In contrast, fat embolism syndrome is an inflammatory and biochemical condition associated with free fatty acids released into the blood that produce a syndrome of petechial rash, respiratory distress, and cerebral dysfunction approximately 24–72 h after surgery. A suggestion for preventing fat accumulation and emboli is continuation of intravenous fluids for 24 h after surgery to flush fatty material through the circulation.

Blindness has been recently reported in patients undergoing liposuction who develop a significant anemia and decreased retinal circulation. This makes it very important to monitor the hematocrit in these patients and keep them well hydrated and volume expanded to avoid hypotension.

Skin necrosis is uncommon in liposuction, except in diabetic patients and people who have scars from previous procedures. Because many MWL patients meet these criteria, they should be warned in advance of the necrosis risk.

**Mons reduction**

If undermining can be avoided, postoperative complications such as skin necrosis and delayed wound healing are uncommon because tissues in this area are very well vascularized. However, lymphatic drainage is compromised when mons reduction is combined with a CBL or thigh lift. This results in prolonged postoperative lymphedema and hyperemia that can resemble cellulitis. Empiric antibiotic therapy can be used but is often unnecessary. Sensation is temporarily altered but usually resolves. Hypersensitivity of the clitoris in women can be a problem if aggressive lifting and reduction of the mons are performed. It may improve over time but can lead to permanent discomfort. Should this be a problem, desensitization creams can be helpful.

**Intergluteal reduction**

The most significant complication associated with intergluteal reduction is delayed wound healing. This region is a ‘watershed’ of blood supply that may become compromised by overresection and undue tension on the closure. Having the patient bend over when marking the central posterior incision adds an additional safety margin. Closure of ‘dead space’ with a layered closure helps prevent seromas that could lead to wound separation. Covering the anal region with a povidone–iodine (Betadine)-soaked towel prevents contamination of the sutures during closure, and sealing the incision with Dermabond reduces fecal contamination. Careful attention to cutting the deep SFS sutures close to the knot helps lessen suture burden, extrusion (spitting), and potential infection. This procedure can be eliminated by incorporating an inverted dart incision into the CBL and/or gluteal augmentation.

**Autologous gluteal augmentation**

Complications directly related to autologous gluteal augmentation are relatively uncommon in our practice. The robustness of vascularization in the area produces good flap viability, which can be confirmed with a Wood’s lamp and fluorescein dye. Small areas of fat necrosis are typically allowed to resorb on their own. Seromas due to large dead spaces can be avoided by putting drains in the most dependent portion of the gluteal pocket. If seroma does occur, management is important because it can precipitate wound dehiscence. (Sclerosis with doxycycline was described earlier.) We do not routinely use quilting sutures in this area, but they may be helpful.

Delayed wound-healing rates for our CBL patients with and without gluteal augmentation do not appear to be significantly different. Nonetheless, inferior flap undermining and tension on the closure increases when gluteal augmentation is added, and this can lead to wound-healing problems plus anorectal hypersensitivity and maceration due to overexposure of the anus. Maceration is usually self-limited and can be managed by topical anesthetics such as hydrocortisone (Anusol), a ‘doughnut’ cushion for sitting, frequent positional changes, high-fiber diet, sitz baths, or baby wipes for cleansing.

Until gaining experience with gluteal autoaugmentation, we advise careful preoperative planning and conservatively sized island flaps to avoid overresection that may lead to wound-healing problems, skin necrosis, and dehiscence. Although this may limit the quality of initial results, aesthetic outcomes will significantly improve with experience. Secondary excisional touch-up procedures such as adjunctive flank liposuction and infragluteal fold excisions can further refine aesthetic outcomes.

**Axilloplasty**

The critical neurovascular structures of the axilla are less likely to be injured if surgical dissection remains above the axillary fascia. Inevitably, the fascia will be violated from time to time. The structures most likely to be injured are the intercostobrachial nerve, the lower roots of the brachial plexus, and the axillary lymphatics. Injury to the intercostobrachial nerve can be treated by neurorrhaphy or proximal transposition. Because brachial plexus injury is more problematic, it is best avoided; if injury does occur, prompt consultation with a peripheral nerve specialist is recommended.

Inadvertent excision or transection of lymphatics results in lymphorrhea and lymphoceles, but these can be prevented by tying off the afferent channels if nodes are involved in the tissue to be resected. If problems occur, distally inject lymphazurin
blue and surgically localize the involved afferent channels with ligation. Sclerosis of a lymphocele with high-dose doxycycline (100 mg per 10 cc of 0.9% normal saline) is sometimes helpful. Wound dehiscence in the axilla results from undue tension caused by overexcision. Anchoring the SFS to the axillary fascia with #1 Vicryl Plus should help reduce tension on the skin closure.

**Autologous breast augmentation**

Complications from autologous breast augmentation utilizing a lateral thoracoepigastric flap in conjunction with axilloplasty and mastopexy can largely be avoided with careful preoperative planning. Skin excision with a Passot “no vertical scar” technique makes redistribution of the axillary skin and lateral breast flap easier than when a Wise pattern excision is used. It also reduces the problem of lateral displacement of the nipple-areolar complex. It is often helpful to mark the lateral breast flap immediately posterior to the anterior axillary line or the pectoralis major muscle border. Doing so leaves a small margin of extra lateral breast flap skin that helps prevent overresection. In addition, careful dissection and leaving a layer of adipose tissue over the lateral chest wall prevents injury to the fourth and fifth intercostal nerves. Once the autologous tissue is added to the breast mound, tension on the breast skin can be significant. Meticulous pedicle dissection avoids compromising the circulation of the nipple areolar complex.

**CONCLUSION**

Almost all MWL patients will benefit greatly from liposuction added as part of the staged procedures often required to achieve optimal aesthetic results. Circumferential debulking liposuction is especially useful for patients who have excess subcutaneous fat, particularly if it is distributed throughout the body, as is typical in patients with a BMI of 30 kg/m² or higher. In this context, LVL can have a major impact on final body contour if performed as the first stage. Other patients have localized lipodystrophies that are easily treated with liposuction. For patients who prefer not to undergo multiple staged excisional surgeries, liposuction offers an alternative with few risks and quick recovery time. If too much excess skin remains after liposuction, an excisional procedure can be scheduled.

The complexity of deformities after MWL is unprecedented in plastic surgery. Body contouring in this population challenges our ingenuity, creativity, and surgical skills on a regular basis. The adjunctive techniques described here have enabled us to improve clinical outcomes and enhance satisfaction among our patients.

**REFERENCES**


