Cosmetic Case Report

# Large-Volume Liposuction Complicated by Retroperitoneal Hemorrhage: Management Principles and Implications for the Quality Improvement Process

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Liposuction is considered a safe and efficacious procedure, especially when using the tumescent technique. However, it can be associated rarely with major medical complications and even death.[1–6] Major vascular injury after liposuction has been reported previously in the European literature but has only been presented anecdotally by surgeons in the United States. Herein, we present the case of exsanguinating retroperitoneal hemorrhage that led to cardiopulmonary arrest in an obese 47-year-old woman who underwent large-volume liposuction of the abdomen, flanks, buttocks, legs, and arms on an outpatient basis.

## Case Report

A 4-foot 11-inch, 135-pound, American Society of Anesthesiologists class III, 47-year-old woman with a history of mild depression and anxiety treated with paroxetine underwent outpatient liposuction in an ambulatory surgery facility. Preoperative evaluation consisted of routine history and physical examination and screening blood tests, which were all normal. The preoperative hematocrit was 36.4 percent, and the patient was started on iron as an outpatient. The operative time was 2 hours for tumescent liposuction of the abdomen, flanks, hips, back, and extremities, during which time 7800 ml of fat and fluid were aspirated. The patient received 5000 ml of lactated Ringer's solution intravenously during the operation, and an additional 3000 ml of lactated Ringer's solution was injected subcutaneously. A total of 825 mg of lidocaine was administered by the surgeon as part of the injectate. Multiple access incisions approximately 5 mm in length were made throughout the operative field, including the umbilicus and bilateral inguinal regions. A 3- to 4-mm Mercedes-tip cannula was used for the aspiration. The patient was hemodynamically stable with normal vital signs throughout the case and was transferred to the recovery room after extubation. No intraoperative complications were reported.

In the recovery room, the patient emerged obtunded from anesthesia, despite vital signs reported to be normal and stable. Within 20 minutes of arrival to the recovery room, she was given 0.5 mg of flumazenil and 0.1 mg of naloxone, with no response. This was followed by another dose of flumazenil 10 minutes later, 2 mg of phyosostigmine given 3 hours after admission to the recovery room, followed by a second dose of naloxone, all without effect. She became unresponsive and began to experience respiratory distress approximately 4 hours after her arrival to the recovery room. Her blood pressure at that time was recorded as 140/60, with a heart rate of 105 beats/min and an oxygen saturation of 100 percent. A decision was made to transfer the patient to the nearest emergency room approximately 4 hours and 15 minutes after her admission to the recovery room. The patient had received a total of 5000 ml of lactated Ringer's solution in the recovery room and had a total urine output of 400 ml.

On admission to our emergency department, the patient was in respiratory distress and had a barely palpable pulse with no obtainable blood pressure. Her Glasgow Coma Score was 3. She was intubated, and cardiopulmonary resuscitation was initiated. The trauma team was notified, and the patient was resuscitated according to the advanced trauma life support protocol. The initial hematocrit on admission to Emergency Department was 12 percent. The patient received lactated Ringer's solution wide open and five units of type-specific, uncrossmatched blood. A diagnostic peritoneal lavage was grossly positive. The patient underwent emergent exploratory laparotomy.

During surgery, the patient remained hypotensive despite fluids, blood, and vasopressor support. The aorta was cross-clamped at the diaphragm for 18 minutes. A massive retroperitoneal hematoma was present, but the exact source could not be identified. The patient's condition was deteriorating (hypothermia, coagulopathy, acidosis, and refractory hypotension), and a decision was made to pack the retroperitoneum with laparotomy pads, close the abdomen using a tem-

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porary "damage-control" technique,[7] and transfer the patient to the surgical intensive care unit for further resuscitation and stabilization. She received 12 units of packed red blood cells, 5 units of fresh frozen plasma, 12 units of platelets, and 10 liters of crystalloid fluid in the operating room and had a 1400-ml urine output during the 2-hour, 45-minute procedure.

The patient was discharged from the operating room with a temperature of 31.8° C and a systolic blood pressure of 80 mm Hg. Rewarming to 36° C was achieved within 3 hours, at which time systolic blood pressure of 120 mm Hg was maintained on high-dose norepinephrine and phenylephrine. APACHE II and III scores calculated from the worst physiologic values obtained during the first 24 hours of intensive care were 41 and 133, respectively,[8,9] suggesting a mortality risk of >90 percent. Despite transfusion of 6 units of packed red blood cells, 6 additional units of platelets, and 2 units of cryoprecipitate overnight, the patient continued to bleed. An angiogram was therefore obtained at approximately 12 hours postinjury, which revealed bilateral L2 lumbar arterial extravasation and pseudoaneurysm (Fig. 1, *left* and *center*). The vessels were embolized successfully with gel-foam (Fig. 1, *right*). A computed tomography scan of the head was obtained after the arteriogram for persistent coma, which revealed bilateral basal ganglia infarcts consistent with hypoxic/ischemic encephalopathy.

Over the course of the next 48 hours, the patient's condition stabilized, and the packing was removed in the operating room. The patient was extubated on hospital day 7, at which point she had a near-normal neurologic exam (GCS 15). She was able to move all four extremities but did have some weakness and swelling of the right arm. Duplex ultrasound revealed bilateral nonocclusive subclavian vein thrombosis, and the patient was started on low molecular weight heparin. Electromyography was consistent with an upper trunk and posterior cord brachial plexopathy, which ultimately resolved. Her hospital course was complicated further by a midline abdominal wound infection, a pulmonary embolism, requiring a percutaneous vena cava filter, pneumonia, and persistent atelectasis secondary to phrenic nerve palsy, which resolved before discharge. After beginning inpatient rehabilitation, she was discharged to an outpatient rehabilitation facility on hospital day 27.

## DISCUSSION

Liposuction is one of the procedures performed most frequently by aesthetic surgeons. Whereas numerous surveys and analyses have reported it to be a safe and efficacious procedure, especially when using the superwet or tumescent technique, liposuction has been associated rarely with a variety of major complications. The overall complication rate in the literature varies from <1 to 9.3 percent,[10–19] although actual numbers are difficult to ascertain because these figures are based largely on voluntary response to surveys and because criteria defining major and minor complications have not been adopted uniformly.[20] In addition, the plastic surgical literature is characterized by a paucity of detailed reports regarding the major complications of liposuction. Many of the more serious complications have appeared in the literature only as case reports or as lesser descriptions communicated by letter.

Major complications resulting from liposuction include embolization (pulmonary or fat),[3–5,11,21,22] cardiovascular problems such as arrhythmia or cardiogenic shock,[1,5,11,23] perforation of the peritoneum or pleura,[10,11,18,24,25] pulmonary edema,[26] and hypovolemic shock.[12,20,23] The overall mortality rate is <1 percent. This is the first report of hypovolemic shock secondary to direct vascular injury, although hematoma formation is recognized.[15,17,18] Far more common is shock secondary to large-volume liposuction without adequate resuscitation. Early reports suggested that single-stage resections should not exceed 1500 ml,[27–29] but experience has shown that large-volume liposuction may be performed safely as long as careful attention is paid to fluid and blood loss and their replacement. It was previously believed that the average blood content of liposuctioned fat was 15 to 30 percent.[30,31] Many surgeons therefore recommended routine transfusion of autologous

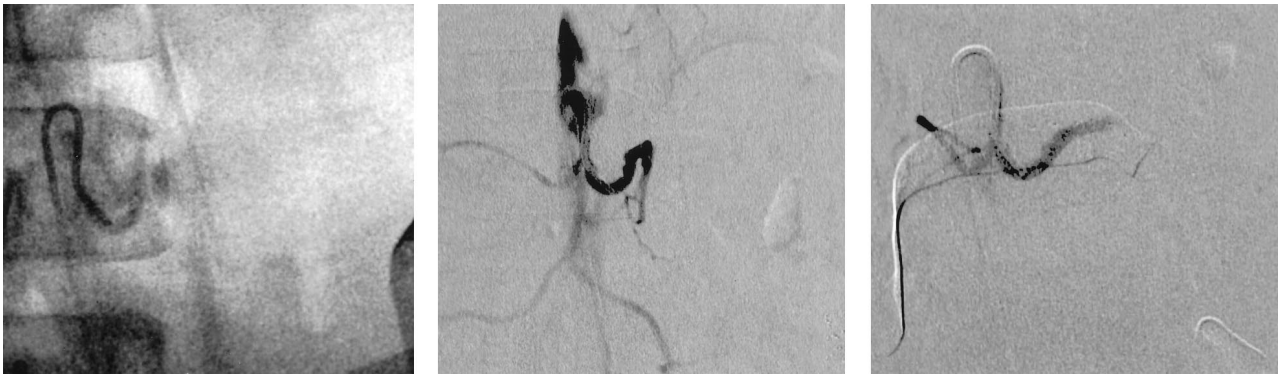

FIG. 1. Digital subtraction angiogram, obtained 12 hours postinjury. (*Left*) Left lumbar (L2) arterial extravasation. (*Center*) Left lumbar (L2) pseudoaneurysm. (*Right*) Left lumbar (L2) artery after embolization with gel-foam.

blood whenever an excess of 1500 ml of fat was removed.[30] With the popularization of liposuction using tumescent technique, blood loss is found to be reduced dramatically[31] (to approximately 1 percent of the volume aspirated), and routine postoperative blood replacement therapy is seldom necessary. Depending on the volume of the aspirate and the use of epinephrine or other vasoconstricting agents injected prior to aspiration, blood loss can become a major issue, and transfusion should be considered in any hemodynamically unstable patient in the immediate postoperative period. In evaluating a group of 45 patients who underwent large-volume liposuction using a combination of tumescent plus ultrasonic technique, Albin and deCampo[32] calculated blood loss from hematocrits drawn preoperatively and those drawn on the fifth postoperative day. Regression analysis showed no correlation between aspirated volume and blood loss. The authors showed that most of the procedure-related bleeding occurs in the tissues, not into the suction canister, and suggested that the observation of minimal external blood loss does not mean that actual blood loss is minimal.[32]

The advent of new technologies has rendered the removal of large volumes of fat commonplace, but several safety issues remain unaddressed. The number of complications and deaths resulting from these procedures has increased significantly over the past several years.[1,33] Although blood loss has been reduced with new techniques, large-volume liposuction using the tumescent technique may be associated with major fluid shifts and third-space sequestration, potentially resulting in either hypovolemia or fluid overload. Fluid resuscitation in these patients remains a matter of considerable debate. In 1999, Trott and colleagues[34] published the first set of guidelines for fluid resuscitation based on a retrospective study of 53 patients who underwent liposuction using a superwet technique. They suggested that patients undergoing large-volume (>4 liters) aspirations should receive maintenance fluid plus subcutaneous wetting solution (1:1 ratio of infiltrate to estimated aspirate, with 30 ml of 1% lidocaine and 1 ml of epinephrine 1:1000 per 1 liter of lactated Ringer's solution) plus 0.25 ml of intravenous crystalloid per ml of aspirate removed >4 liters. Based on this guideline, our patient, who received 5 liters of fluid plus 3 liters of wetting solution intraoperatively and an additional 5 liters of fluid in the immediate postoperative period, would have been over-resuscitated had it not been for the bleeding, which was unappreciated before transfer. Because the urine output and vital signs were reportedly normal in the ambulatory facility's recovery room, it is unclear why she received this volume of fluid, although it is likely that the large fluid volume administered in fact may have contributed to her survival.

The dose of lidocaine administered during tumescent liposuction can be as high as 55 mg/kg, which is several times higher than the 4.5 mg/kg dose typically used for subcutaneous infiltration. This dose limit was based on several studies demonstrating that most patients who had received these doses during tumescent procedures had plasma concentrations below the toxic range.[35,36] Plasma concentrations of lidocaine above 5 mg/kg are considered toxic, resulting in neurologic sequelae such as paresthesias, somnolence, and seizures, and ultimately in cardiovascular collapse. Our patient received approximately 14 mg/kg of lidocaine as part of the injectate. Although it is unlikely that lidocaine toxicity contributed to her outcome, it is important to remember in the differential diagnosis of the somnolent patient in the early postoperative period after tumescent liposuction.

Liposuction, when noncomplicated, may be considered analogous to a blunt-type traumatic injury. However, it is important to consider that penetrating injury to major vascular structures may occur if the suction cannula inadvertently enters a deep plane. Any patient who has undergone major surgery to the abdomen and flank region who is hemodynamically unstable in the postoperative period should be treated in accordance with the guidelines set forth by the advanced trauma life support program. Although postoperative shock can be a direct consequence of any number of specific conditions (e.g., cardiovascular compromise, anesthetic complication, drug reaction), hemorrhage is the most common cause of profound hemodynamic instability. Early and aggressive operative intervention is the mainstay of therapy for these patients.

Recently, government agencies have become more involved in safety issues related to aesthetic surgical procedures generally and to liposuction specifically. The Medical Board of California has called for a voluntary morato-

rium on large-volume lipoplasty (defined as removal exceeding 5000 ml of aspirate) outside of a hospital setting.[33] For the first time in the state's history, the Florida Board of Medicine has established regulations governing the safe practice of surgery outside a hospital setting.[37] Office procedures are now limited to 6 hours, and the volume of fluid removed by liposuction is limited to 2000 ml or 5000 ml, depending on the facility. In addition, the Board prohibits overnight stays in the surgeon's office and requires all ambulatory facilities practicing these procedures to be approved by the American Association for Accreditation of Ambulatory Surgical Facilities, the Accreditation Association for Ambulatory Health Care, or the Joint Commission on Accreditation of Healthcare Organizations within a 12-month time frame. Although these regulations provoke considerable debate within the plastic surgery community, many authors echo the concerns of the government.[33,34] It is generally agreed that large-volume liposuction should be considered a moderate to major surgical stress. It can be associated with significant fluid shifts, and when complicated it is associated with operative mortality. Close patient monitoring, both intraoperatively and in the postoperative period, is of tantamount importance to patient outcome.

## SUMMARY

Large-volume liposuction can be associated rarely with major medical complications and death. The case of exsanguinating retroperitoneal hemorrhage that led to cardiopulmonary arrest in an obese 47-year-old woman who underwent large-volume liposuction is described. Extensive liposuction is not a minor procedure. Performance in an ambulatory setting should be monitored carefully, if it is performed at all. Reporting of adverse events associated with outpatient procedures performed by plastic surgeons should be mandated. Hemodynamic instability in the early postoperative period in an otherwise healthy patient may be due to fluid overload, lidocaine toxicity, or to hemorrhagic shock and must be recognized and treated aggressively. Guidelines for the safe practice of large-volume liposuction need to be established.

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