Definition of Tumescent Liposuction

Tumescent liposuction is a hybrid term, which combines a technique of local anesthesia with a methodology of subcutaneous fat removal. With tumescent local anesthesia, dilute lidocaine and dilute epinephrine are delivered by subcutaneous infiltration to provide profound local anesthesia. The profound local anesthesia achieved eliminates the need for general anesthesia and allows for the procedure to be performed completely under local anesthesia or with minimal sedation. The surgical removal of fat is performed after infiltration of the tumescent local anesthesia and involves the use of small cannulas inserted into small incisions, which are later left open to drain. There is a higher proportion of pure fat aspirated during tumescent liposuction, with a very small component of blood compared with the aspirate obtained by other techniques of liposuction. Tumescent liposuction has been shown to be the safest method of fat removal with the fewest complications.

References


History of Technique Development

The technique of modern liposuction had its origin in Europe in the mid-1970s where Georgio and Arpad Fisher, Italian physicians, introduced the idea of fat removal through subcutaneous blunt cannulas. Dermatologic surgeons were among the first US physicians to visit Europe to learn this new technique. In 1983, live interspecialty liposuction teaching courses formally introduced this procedure into the United States. The same year, during the annual meeting of the American Academy of Dermatology, lectures were given on liposuction. The first Dermatology Department to begin teaching liposuction to residents in 1984 was at Tulane University.

In 1985, Jeffrey Klein, an American dermatologic surgeon, revolutionized liposuction with the development of tumescent local anesthesia. Tumescent local anesthesia allowed safe, in-office removal of large volumes of fat with negligible blood loss, quick patient recovery and excellent cosmetic results. Klein published two key scientific studies detailing the pharmacology of tumescent lidocaine anesthesia and tumescent technique.

In 1987, the American Academy of Dermatology officially added liposuction as part of the core surgical curriculum for Dermatology residents. The American Academy of Dermatology was the first specialty organization to approve guidelines of care for liposuction, published in 1989.
References


Safety

Absorption kinetics of dilute tumescent lidocaine anesthesia solutions are profoundly different from that of stock commercial 1% lidocaine solutions. When the concentration of lidocaine absorption is reduced to 0.1% or less, in combination with dilute epinephrine, the serum peak concentrations are decreased and delayed, with peak levels at around 12 hours. The maximum safe dose of tumescent lidocaine has been shown to be 55 mg/kg.

The safety of tumescent liposuction has been well documented. In 1988, Hanke and colleagues surveyed 55 dermatologists who had performed 9,478 liposuction cases. In this group, the risk of developing a systemic complication was 0.07%. Five patients had “excessive” intraoperative or postoperative blood loss, and two patients had infection. There were no reported cases of disseminated intravascular coagulation, fat emboli, perforated vescus, thrombophlebitis, or death. The risk of local complications was also small. Of these, the most common were postoperative contour irregularities (2.1%), hematoma (0.47%), and persistent postoperative edema (0.46%). In 1996, Hanke again surveyed the American Society for Dermatologic Surgery (ASDS) fellows and evaluated data on 15,336 patients. In this group, they reported no serious complications. In 1999, Coleman and colleagues reviewed the National Database of the Physicians Insurance Association of America on malpractice data from 1995 to 1997. They sought to determine whether the location of the liposuction surgery or the specialty of the physician had an effect on the incidence of malpractice claims. Their hypothesis was that in-office liposuction surgery was safer than hospital-based liposuction surgery, contrary to what was commonly believed. In their study, they found that with hospital-based liposuction the rate of malpractice settlements was three times that of office-based liposuction surgery. Their study showed that less than 1% of the defendants were dermatologic surgeons, even though dermatologic surgeons performed about 33% of liposuctions in the United States. In 2002 in a national survey of over 66,000 liposuction cases performed using the tumescent local anesthesia technique, no deaths were reported and the rate of serious adverse events was 0.68 per 1,000 cases. In a review of Florida adverse event data, Coldiron revealed that there were no tumescent anesthesia-related liposuction deaths. There were two deaths related to liposuction under general anesthesia.

References

appropriately trained and experienced physician. The physician performing liposuction should possess in-depth knowledge of the skin and subcutaneous tissues. Depending on the type and extent of liposuction surgery performed, the physician should have knowledge of fluid and electrolyte balance, knowledge of management of potential complications, and knowledge of tumescent anesthesia and other forms of anesthesia employed.

As there is no mechanism for the certification for procedures introduced postresidency in all medical specialties, the ASDS has assumed the mission of educating its members in learning new techniques. As the ASDS is not a certifying body, the organization supports work with certifying bodies to identify those courses that would train physicians with the intent of verifying competency. The ASDS currently provides various training courses that offer didactic instruction with self-test, observational and video instruction, participation by direct performance of the technique, and proctoring with the proctor visiting the office of the trainee or with the trainee bringing patients to the proctor.

The ASDS is currently working with the American Academy of Dermatology to develop a national process of office procedural certification. This process, modeled on the hospital credentialing system, would be administered by an independent board with national experts in various cosmetic disciplines as consultants. It will provide a new gold standard for competence in cosmetic procedures.

**Indications—Aesthetic Body Contouring**

Tumescent liposuction surgery allows the safe removal of excess subcutaneous fat. It is appropriate in people who are at or near their ideal body weight and who wish to undergo selective contouring of excess subcutaneous fat in body locations that have remained resistant to concerted efforts of diet control and exercise. At the other end of the spectrum, people who are not at or near their ideal body weight can benefit from selective liposuction surgery in order to facilitate and improve overall body silhouette and the patient’s ability to fit more favorably into their clothing.

The most common body regions for aesthetic contouring include thighs, abdomen, hips, arms, back, buttock, neck, breast, and calf.

**Other Indications**

Tumescent liposuction surgery offers a safe and effective treatment in other circumstances. These include treatment of lipomas (solitary and multiple), gynecomastia or pseudogynecomastia, lipodystrophy, and axillary hyperhidrosis and axillary bromidrosis. Reconstructive procedures such as mobilization of flaps and subcutaneous fat debulking during scar revision also might be facilitated by tumescent liposuction.

**References**


**Preoperative Evaluation**

The preoperative evaluation allows the dermatologic surgeon to fully assess the patient seeking tumescent liposuction surgery. History should focus on diet patterns, exercise, and familial body shape as well as the specific regions that the patient is unhappy with aesthetically. A thorough medical history should address a history of poor wound healing, bleeding abnormalities including hypercoagulable states, diabetes mellitus, keloid formation, and problems with past surgical procedures. In addition, a history of infectious diseases such as hepatitis or human immunodeficiency virus (HIV) should be obtained. A personal or family history of thrombophlebitis, pulmonary emboli, or multiple miscarriages may influence the relative risk of com-
plications for that particular patient. Medication lists should be documented with special attention to aspirin, nonsteroidal anti-inflammatory agents or anticoagulants. Drugs that may interfere with the metabolism of lidocaine must be noted. The physician should evaluate the patient's expectation of the procedure and verify that the patient is self-motivated to seek correction. As with any cosmetic procedure, the expectations should be reasonably attainable and not be influenced by a body dysmorphic disorder. The surgical procedure should be explained, including the benefits, risks, expected outcomes, and the potential for needing a touch-up procedure.

Reference

Physical Examination
General physical health, as well as evaluation of specific sites amenable to liposuction, should be assessed. The general distribution of adipose and muscle development should be noted as well as making note of a gynecoid or android distribution of fat. A modified complete physical examination as a baseline measure should be performed. It is recommended that patients be in good general health. If there is a question as to health status of a prospective liposuction patient, medical clearance from the appropriate physician is indicated.

The cutaneous examination should include general cutaneous abnormalities such as scars, evidence of poor wound healing from previous procedures or trauma, hernias (abdominal, umbilical, inguinal, genital), and venous varicosities. Particular attention must be paid to evidence of body asymmetry and contour irregularities that may affect the overall aesthetic outcome. The quality of skin tone and elasticity must be assessed in the areas to be treated. Evidence of dimpling and cellulite formation should be carefully noted and pointed out to the patient. Some regional considerations include the following:

Neck: A forward placed hyoid bone may limit the ability to fully contour the anterior neck. An enlarged thyroid gland or submandibular glands can add to neck fullness. Micrognathia in the lower one-third of the face contributes to chin deformity and skin redundancy. If the patient contracts platysma in a grimace, preplatysmal fat can be better defined.

Abdomen: The lateral hip-flexed position (bending over in a diver’s position) is a helpful maneuver to delineate superficial fat from muscle and omental fat.

Outer thigh: It is important to determine the extent to which the weight of the buttocks contributes to the outer thigh deformity. Flexion of the gluteal musculature can help determine the contribution of the adipose in the buttocks to the protuberance of the outer thigh. If the outer thigh protuberance decreases on gluteal contraction, then the weight of the buttocks has a sizeable contribution.

References

Laboratory Studies
Laboratory studies may or may not be necessary for a given patient depending on the type and extent of anticipated liposuction procedure. For those individuals undergoing significant liposuction surgery, the surgeon may wish to obtain a complete blood count with quantitative platelet assessment, prothrombin time, partial thromboplastin time, chemistry profile including liver function tests, urinalysis, beta-HCG, as well as a urine pregnancy test on the day of the procedure for women of childbearing age. Local standards of care may vary and some surgeons may wish to obtain additional studies including screening for HIV, hepatitis B, and hepatitis C.

Tumescent Anesthesia
Mixing of tumescent local anesthesia solutions should be done
by trained personnel in accordance with the order of a physician. The maximum dosage is calculated by multiplying the patient’s weight in kilograms by the planned maximum lidocaine dose (35–55 mg/kg) to give the total lidocaine dosage. To calculate the safe number of liter bags containing the tumescent mixture, one divides mg/L of lidocaine into the maximum lidocaine dosage (mg). For example, a 70 kg patient has a maximum lidocaine dose by tumescent local anesthesia of $70 \times 55 = 3,850$. If the concentration of the lidocaine solution in the tumescent bag is 0.05, then there is 500 mg in each bag. Therefore, one would divide 3,850 by 500 to give a total of 7.7 bags allowable in that patient.

It is important that the physician standardize the practice of mixing the solution in such a way that errors in lidocaine doses do not occur. The ingredients in the tumescent local anesthetic solution are lidocaine, epinephrine, and sodium bicarbonate mixed into normal saline. Triamcinolone may also be used. Concentrations of lidocaine recommended range from 0.05% to 0.1% depending on the sensitivity of the area to be tumesced. On occasions, lidocaine 0.15% has been recommended in small quantities for very sensitive areas such as the female breast. The most commonly used concentrations of lidocaine are 0.1%, 0.075%, and 0.05%. Epinephrine is added in a range from 0.5 to 1.5 mg per 1 L bag of normal saline solution, depending on the area to be tumesced. Approximately 12.55 cc of sodium bicarbonate is usually added to a 1 L bag. Triamcinolone may also be added at 10 mg per 1 L bag.

The physician ordering tumescent local anesthesia mixtures must have a working knowledge of those drugs that can inhibit the cytochrome p450 system that metabolizes lidocaine and can result in elevated blood levels of lidocaine. If these medicines can be discontinued 2 weeks before surgery, this will eliminate their effect on lidocaine metabolism. If they cannot be eliminated, consideration should be given to lowering the maximum dose of lidocaine.

**Reference**


**Tumescent Liposuction: Surgical Technique and Volume Removal**

Tumescent local anesthesia liposuction allows for the safe removal of large volumes of subcutaneous fat without the requirement of general anesthesia on an outpatient basis with minimal blood loss and rapid recovery. Tumescent liposuction is now accepted as the standard of care in liposuction surgery. Liposuction may be performed safely in the office setting or ambulatory surgical center, offering convenience, price economy, and minimal risk of nosocomial infections when compared with the hospital setting. To date, hundreds of thousands of liposuction cases have been performed in this manner, with no reported fatalities when tumescent anesthesia alone is utilized.

Tumescent local anesthesia usually provides complete and profound anesthesia to all areas infiltrated. Oral anxiolytics are often helpful to relieve patients’ general concerns over having a procedure. When the region to be treated is adequately tumesced, additional pain management in the way of intramuscular or intravenous sedation is often unnecessary. However, supplemental oral or intramuscular sedation can sometimes be useful during the infusion of the tumescent anesthetic.

Most cannulas used are less than 4 mm in diameter. Cannula shape, placement, and number of holes can alter the characteristics of the fat removed. At this time, it is recommended that removal of more than 4 L of supranatant fat be divided into more than one operative session. In a large survey, the mean amount of combined fluid and fat removed by liposuction surgeons during one case was 1,740 mL, with the mean amount of pure fat removal being approximately 1,160 mL.

Patient monitoring varies depending on the extensiveness of...
the surgical procedure and the degree of anesthesia involved. Local standards of care may influence the surgeon’s decision on monitoring. In larger cases, where conscious sedation is utilized, it is recommended that monitoring include pulse oximetry, continuous cardiac monitoring, and intermittent monitoring of blood pressure, heart rate, and respiratory rate. It is also recommended that for conscious sedation, resuscitative equipment be immediately available and members of the operative team be certified in advance cardiac life support procedures.

References

Ultrasonic-Assisted Liposuction (UAL): Internal and External

Internal UAL is a procedure that was briefly popular in the 1990s, but is used less commonly today. Although originally promoted as a technique that would increase fat removal, decrease exertion on the part of the surgeon, and decrease blood in the aspirate, these claims have not been substantiated by careful study. Many of the surgeons initially enthusiastic about UAL had not used tumescent local anesthesia before UAL. For UAL, the fat must be tumesced before ultrasound is applied. The original advantages reported can largely be attributed to the benefits tumescent local anesthesia affords when compared with dry liposuction. In addition, some studies show higher risks for complications with internal UAL. External UAL has been shown to be ineffective for preoperative fat dissolution. Postoperatively, there is only anecdotal evidence that external ultrasound offers any benefit. In one side-by-side placebo study of 25 patients, no advantage of external ultrasound versus placebo was shown.

References

Power-Assisted Liposuction

Power-assisted liposuction utilizes a reciprocating “to and fro” cannula to optimize the amount and rate of fat removal. In contrast to traditional liposuction, rapid manual movement through the fat is not required. This may help to decrease the physical exertion of the surgeon during the procedure as well as improve tolerability of liposuction in more sensitive areas such as the umbilicus. In some studies, power-assisted liposuction has been shown to decrease the operative time and improve patient recovery.

References

Monitoring

Tumescent liposuction is performed most commonly in physicians’ offices or ambulatory surgical centers. An advantage of these settings is that the risk of nosocomial infections from hospital settings is minimized. The need for intraoperative monitoring depends on the health and age of the patient and on the level of sedation. The level of monitoring is often determined by state guidelines.
Baseline vital signs should always be recorded: blood pressure, heart rate, and respiratory rate. If any medications have been given that may directly or indirectly produce hypoxia, the patient should be monitored with a pulse oximeter, according to state guidelines, and supplemental oxygen should be made available. The need for blood pressure monitoring is determined by the health of the patient and the level of sedation. In a patient with a cardiac history or a history of hypertension, or any medication is given that has a potential for causing hypotension, blood pressure monitoring should be corrected out according to state guidelines. Replacement fluids are not necessary with the tumescent technique as there is sufficient absorption of fluid through hypodermoclysis.

Minor contour imperfections may also develop. All patients experience a minimal amount of residual edema, which usually resolves within days. Typically, there is minimal bruising limited to cannula insertion sites, but some patients will have a greater degree of ecchymosis. Almost all patients will experience some dysesthesia that tends to resolve within several months following their procedure.

Occasionally, patients will experience local adverse reactions including persistent edema; prolonged dysesthesia, which often manifests as hypesthesia; hyperpigmentation at the cannula insertion sites; asymmetry; hematoma or seroma formation; contour irregularities; drug reactions; or tape reactions.

When modified tumescent local anesthesia is used in the setting of general anesthesia, serious complications have been reported as a result of aggressive fat removal and excessive intravenous fluids. In addition, the patient is at risk for complications inherent to general anesthesia such as anoxia, pulmonary embolus, cardiac arrhythmias, intrathoracic or intraperitoneal perforation, and death. Fat emboli have also been reported with dry technique liposuction.

Complications inherent to any surgery are also in the risk profile for liposuction: infections, hema-

toma or seroma, nerve damage, and skin necrosis.

References

Postoperative Course
Many surgeons utilize compression garments in the form of binders, girdles, or elastic tape to minimize bruising, discomfort, hematoma or seroma formation, and fluid shifts within the tissue. Improved aesthetic results may be obtained with the use of compression garments. Most liposuction surgeons recommend wearing compression garments in a range from 1 to 4 weeks. The average length of time for wearing postoperative garments following liposuction surgery is two weeks. Antiphlebetic support stockings may be valuable for liposuction cases involving the lower extremities.

Most patients should remain ambulatory following surgery with the tumescent local anesthesia technique. Patients should resume their usual exercise activities as comfort allows.

References
2. Lawrence N, Butterwick KJ. Immediate and long-term postoperative care
The principles outlined in these guidelines will not ensure successful treatment. These guidelines are not intended to be inclusive of all proper methods or exclusive of other reasonable methods in obtaining similar results. Just as in the appropriate practice of any surgical procedure, the physician must exercise ultimate judgment in light of all the circumstances of individual patients.

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