

## Anesthesia for Liposuction – A Review

Dr. Yugam,<sup>1</sup>  Lt col (Dr)Raj Narayan Mandal,<sup>2</sup>  Dr. Manoj Kumar Behera,<sup>3</sup>   
Dr. Tapas R Panigrahi,<sup>4\*</sup> 

1. Senior Consultant, Department of Anesthesia and Critical Care RG Laproscopy and Urology Hospitals, Ludhiana, India
2. Assistant Professor, Department of Anaesthesia and Critical care, 167 Military Hospital, Pathankot, Punjab, India.
3. Senior Resident, Department of Anaesthesia, Consultant Rotary club of Purulia, India.
4. Post Graduate, Department of Anaesthesia and Critical care, Veer Surendra Sai Institute of Medical Science and Research, Dang, Odisha, India

### \*Corresponding Address:

Dr. Tapas R Panigrahi, Post Graduate, Department of Anaesthesia and Critical care, Veer Surendra Sai Institute of Medical Science and Research, Dang, Odisha, India Email id: [morningstarp25@gmail.com](mailto:morningstarp25@gmail.com)

### Abstract:

Liposuction is a widely performed cosmetic procedure aimed at removing localized fat deposits to enhance body contour. The choice of anesthesia plays a crucial role in ensuring patient safety, comfort, and optimal surgical outcomes. Various anesthesia techniques, including local anesthesia, tumescent anesthesia, regional anesthesia, and general anesthesia, are employed based on patient factors, procedural complexity, and surgeon preference. Tumescent anesthesia, a widely used technique, offers advantages such as reduced bleeding, prolonged analgesia, and minimal systemic effects. General anesthesia is preferred for extensive liposuction cases requiring multiple body areas to be treated. The selection of anesthesia should consider factors like patient comorbidities, anticipated surgical duration, and the risk of complications such as lidocaine toxicity, deep vein thrombosis, or airway compromise. Proper patient assessment, intraoperative monitoring, and postoperative pain management are vital to ensure a smooth recovery and satisfactory results. This review discusses various anesthetic techniques used in liposuction, their advantages, risks, and considerations for safe and effective practice.

**Keywords:** Anesthesia, liposuction, local anesthesia, tumescent anesthesia, regional anesthesia

### Introduction:

Liposuction, one of the most commonly performed aesthetic surgical procedures worldwide, involves the removal of excess adipose tissue through suction-assisted techniques.<sup>[1,2]</sup> This procedure is sought after for body contouring rather than weight loss and is performed on various anatomical regions, including the abdomen, thighs, arms, and back. While liposuction is generally safe, the choice of anesthesia significantly impacts the safety, efficiency, and patient experience associated with the procedure. The type of anesthesia selected is based on the volume of fat to be removed, the area being treated, the surgeon's expertise, and patient-specific factors such as underlying medical conditions and pain tolerance.<sup>[3-6]</sup>

The primary anesthesia techniques used in liposuction include local anesthesia, tumescent anesthesia, regional anesthesia, and general anesthesia. Local anesthesia is typically reserved for small-volume liposuction procedures, while tumescent anesthesia has become the standard for most cases due to its efficacy and safety profile. Tumescent anesthesia involves the infiltration of large volumes of diluted local anesthetic mixed with epinephrine into the subcutaneous fat, minimizing bleeding and providing prolonged analgesia. Regional

anesthesia, including epidural and spinal blocks, may be used for larger areas of liposuction, particularly in the lower body. General anesthesia is preferred in extensive liposuction cases, especially when multiple areas are treated simultaneously, as it ensures patient immobility and comfort. [7]

The administration of anesthesia in liposuction requires careful consideration of potential complications. While local and tumescent anesthesia are associated with a lower risk of systemic complications, excessive lidocaine doses may lead to toxicity, manifesting as neurological and cardiovascular symptoms. General anesthesia, though offering complete pain relief, carries risks such as airway compromise, deep vein thrombosis, and prolonged recovery times. Therefore, patient selection, preoperative assessment, and adherence to safe anesthetic practices are critical in optimizing surgical outcomes. [8]

This article provides an in-depth review of anesthesia options for liposuction, outlining their advantages, disadvantages, and safety considerations. By understanding the various anesthetic techniques, surgeons and anesthesiologists can tailor anesthesia plans to individual patient needs, enhancing the safety and success of liposuction procedures.

### **Types of Liposuctions:**

There are several liposuction techniques available, each with distinct advantages and limitations. [9] The choice of technique influences the anesthetic approach and overall patient experience.

- A) **Traditional Suction-Assisted Liposuction (SAL)** – This method uses a cannula connected to a vacuum pump to aspirate fat. It is effective but may result in more tissue trauma and bruising compared to newer techniques.
- B) **Ultrasound-Assisted Liposuction (UAL)** – This technique uses ultrasonic energy to liquefy fat before suctioning, making it easier to remove. UAL is beneficial for fibrous areas like the back or male chest but carries a risk of burns.
- C) **Laser-Assisted Liposuction (LAL)** – This method utilizes laser energy to break down fat cells and promote skin tightening. It offers less trauma and quicker recovery times but may require more extensive training.
- D) **Power-Assisted Liposuction (PAL)** – PAL involves a vibrating cannula that facilitates fat removal with less effort. It is particularly useful for high-volume fat extraction and reduces operator fatigue.
- E) **Water-Assisted Liposuction (WAL)** – This technique employs a pressurized stream of water to dislodge fat cells gently. WAL minimizes trauma, leading to less pain and bruising postoperatively.

Each of these techniques requires a specific anesthetic approach, with tumescent anesthesia being commonly used in most cases. General anesthesia may be necessary for larger-volume liposuction or cases requiring extensive sculpting.

### **Low- and High-Volume Liposuction:**

Liposuction procedures are categorized based on the volume of fat removed. **Low-volume liposuction** typically involves the removal of less than 5 liters of fat and is usually performed under local or tumescent anesthesia. It is considered safer, with a lower risk of complications such as fluid imbalance and hemodynamic instability. Patients undergoing low-volume liposuction often experience quicker recovery and minimal postoperative discomfort.

**High-volume liposuction**, on the other hand, involves the removal of more than 5 liters of fat and requires meticulous anesthetic management. This procedure is commonly performed under general anesthesia due to the extensive surgical duration and potential for significant fluid shifts. High-volume liposuction carries higher risks, including hypovolemia, electrolyte imbalance, and increased postoperative complications. Close intraoperative monitoring of fluid balance, blood loss, and thermoregulation is crucial to ensure patient safety. Patients undergoing high-volume liposuction may require postoperative observation and intravenous fluid resuscitation to prevent complications such as hypotension and deep vein thrombosis. <sup>[10]</sup>

Liposuction is a minimally invasive body contouring procedure that has evolved significantly over the years. The technique involves the aspiration of subcutaneous fat using cannulas connected to suction devices. Given the variability in procedural complexity, different anesthetic techniques are utilized to ensure patient comfort, minimize intraoperative bleeding, and facilitate postoperative recovery. The choice of anesthesia depends on multiple factors, including procedural extent, patient tolerance, and the surgeon's preference. <sup>[11-14]</sup> Tumescent anesthesia is widely used due to its benefits of prolonged analgesia, reduced intraoperative bleeding, and minimal systemic effects. However, excessive lidocaine administration can lead to toxicity, requiring precise dosing calculations. General anesthesia, while effective for large-volume liposuction, carries risks such as airway compromise, postoperative nausea, and deep vein thrombosis. Anesthesia must be tailored to each patient, considering comorbidities, procedural complexity, and anticipated surgical duration. <sup>[15]</sup>

Postoperative pain management strategies, including multimodal analgesia with NSAIDs, opioids, and local anesthetics, play a crucial role in ensuring a comfortable recovery. Close monitoring for complications such as fluid shifts, hypothermia, and cardiovascular instability is necessary to enhance patient safety and optimize outcomes.

### **Wetting solutions in liposuction:**

Wetting solutions play a crucial role in liposuction procedures by facilitating fat removal, reducing bleeding, and enhancing patient comfort. These solutions are infused into the targeted adipose tissue before suctioning, helping to loosen fat cells and minimize surgical trauma. The use of wetting solutions has significantly improved liposuction safety by decreasing intraoperative blood loss and reducing postoperative pain and complications. <sup>[16]</sup>

### **Why wetting solutions are used?**

The primary purpose of wetting solutions in liposuction is to create a controlled surgical environment. A significant benefit is the reduction of blood loss, which is achieved through vasoconstriction, primarily induced by epinephrine. The anesthetic component of the solution ensures that

patients experience minimal discomfort both during and after the procedure. Wetting solutions also facilitate fat removal by softening the fat tissue, thereby reducing mechanical resistance and making suctioning more efficient. Additionally, their use helps minimize postoperative complications such as hematomas, excessive bruising, and swelling, ultimately leading to improved surgical outcomes and patient satisfaction.

#### **Types of wetting solutions:**

Different types of wetting solutions are used in liposuction, depending on the extent of the procedure, surgeon preference, and patient-specific considerations. The dry technique, which involves no pre-infiltration of fluids, is associated with significant blood loss, making it an outdated and rarely used approach. The wet technique involves injecting a small amount of fluid (approximately 200–300 mL per treatment area) before liposuction, which reduces blood loss compared to the dry method but does not offer significant anesthetic benefits. The super-wet technique involves infiltrating fluid in a 1:1 ratio to the expected aspirate volume, providing better hemostasis and pain control than the wet technique while minimizing the risks of fluid overload. The most widely used method is the tumescent technique, which involves infiltrating large volumes of diluted local anesthetic (usually lidocaine) mixed with epinephrine and saline or lactated Ringer's solution. This technique significantly reduces intraoperative blood loss, enhances postoperative analgesia, and in many cases, eliminates the need for general anesthesia. [17,18]

#### **Complications of wetting solutions:**

While wetting solutions have greatly improved the safety and efficacy of liposuction, improper use can lead to complications. Lidocaine toxicity is a significant concern when excessive amounts of tumescent solution are infiltrated, potentially leading to systemic toxicity, which can cause neurological and cardiovascular effects such as dizziness, seizures, and arrhythmias. Fluid overload is another potential risk, particularly in high-volume liposuction cases, as excessive administration of wetting solutions can lead to pulmonary edema, electrolyte imbalances, and cardiovascular strain. [19-21] Epinephrine-related complications, such as hypertension, tachycardia, and cardiac arrhythmias, can occur if high doses are used, posing risks, especially for patients with preexisting cardiovascular conditions. Additionally, there is a risk of infection if contaminated solutions are used or if improper infiltration techniques are employed. To minimize these risks, it is essential to follow precise dosing guidelines, carefully monitor the patient throughout the procedure, and adhere to strict safety protocols to ensure a successful and complication-free liposuction outcome.

#### **Anesthetic and surgical implications of wetting solutions:**

The use of wetting solutions has significant anesthetic and surgical implications in liposuction procedures. From an anesthetic perspective, the composition of the solution, particularly the inclusion of lidocaine, determines the level of pain control and the need for additional anesthesia. In cases where tumescent anesthesia is used appropriately, it may eliminate the need for general anesthesia, reducing associated risks such as airway complications, prolonged recovery, and systemic side effects. However, careful calculation of lidocaine dosage is required to avoid toxicity, particularly in large-volume liposuction cases. Patients must be

closely monitored for signs of systemic absorption, including altered mental status and cardiovascular disturbances.

From a surgical standpoint, the choice of wetting solution influences the ease of fat extraction and the extent of tissue trauma. Proper infiltration allows for even distribution of the solution, reducing resistance during suctioning and minimizing damage to surrounding structures. Surgeons must balance the volume of fluid used to prevent excessive fluid retention, which can lead to complications such as fluid shifts, hemodynamic instability, and prolonged edema. Additionally, careful technique is required to avoid inadequate infiltration, which could result in increased bleeding and discomfort during and after the procedure. By understanding these anesthetic and surgical considerations, practitioners can optimize patient safety, minimize complications, and achieve superior cosmetic results in liposuction procedures

### **Thermoregulation and liposuction:**

Thermoregulation is a critical consideration in liposuction procedures, as patients are at risk of both intraoperative and postoperative temperature fluctuations. The infusion of large volumes of wetting solutions, particularly when cold fluids are used, can lead to hypothermia, which may result in vasoconstriction, increased blood viscosity, impaired wound healing, and altered drug metabolism. Hypothermia can also prolong recovery time and increase the risk of cardiac complications in susceptible individuals.

To mitigate the risk of hypothermia, pre-warmed wetting solutions are often used, along with warming blankets, heated operating room environments, and active patient monitoring. Conversely, excessive heat generated from energy-assisted liposuction techniques, such as laser-assisted or ultrasound-assisted liposuction, may lead to hyperthermia, tissue burns, and thermal injuries if not carefully controlled. Proper thermoregulatory management ensures optimal surgical conditions, enhances patient safety, and promotes a smooth postoperative recovery.

### **Intraoperative monitoring and post-operative analgesia:**

Intraoperative monitoring is crucial in liposuction to ensure patient safety and prevent complications. Continuous monitoring of vital signs, including heart rate, blood pressure, oxygen saturation, end-tidal carbon dioxide levels, and body temperature, helps detect early signs of complications such as lidocaine toxicity, fluid overload, or hemodynamic instability. Large-volume liposuction procedures, in particular, require careful assessment of fluid balance and blood loss to prevent hypovolemia or excessive fluid administration. In patients receiving general anesthesia or deep sedation, airway management and respiratory monitoring are critical to avoid hypoxia or respiratory depression.<sup>[22]</sup>

Post-operative analgesia plays a significant role in patient recovery, ensuring comfort and reducing the need for opioid analgesics. Tumescent anesthesia provides prolonged pain relief due to the sustained effects of lidocaine, often reducing post-operative discomfort for several hours. However, additional analgesic strategies may be required, including non-steroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and in some cases, regional nerve blocks. Adequate pain control not only improves patient satisfaction but also facilitates early mobilization, reducing the risk of complications such as deep vein thrombosis and enhancing

overall recovery outcomes. A multimodal analgesic approach combining pharmacologic and non-pharmacologic methods is ideal for optimizing post-operative comfort while minimizing side effects.

### **Conclusion**

The selection of anesthesia for liposuction is a critical factor influencing patient safety, comfort, and surgical outcomes. While local and tumescent anesthesia offer significant advantages for small to moderate liposuction procedures, general anesthesia remains necessary for extensive fat removal. A thorough understanding of anesthetic options, patient-specific considerations, and adherence to safety guidelines are essential in optimizing liposuction results while minimizing risks. Future advancements in anesthesia techniques may further enhance the efficacy and safety of liposuction procedures.

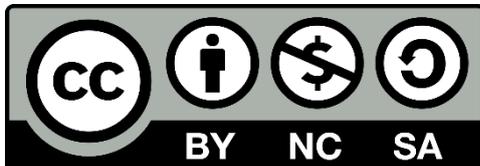
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