

Review Article

Indications and techniques of liposuction

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Received : 20 October 2022
Accepted : 25 October 2022
Published : 10 November 2022

DOI
10.25259/CSDM_124_2022

Quick Response Code:



ABSTRACT

Liposuction is the procedure used in the majority of countries around the world for cosmetic surgery. It is safe and produces immediate results that are esthetically pleasing and get better over time. Over the past two decades, it has grown from a procedure that facilitates small or spot reductions to one that has become an almost irreplaceable tool in the esthetic surgery armamentarium in neck, breast, and circumferential body contouring. The development of liposuction from mechanical debulking to sophisticated high-definition body contouring and proportioning surgery over the past four decades has made it possible to sculpt the shape of a figurine. In this review article, we aspire to discuss the indications, techniques of liposuction, and its evolution over the years.

Keywords: Liposuction, Indications, Techniques

INTRODUCTION

Liposuction is the procedure used in the majority of countries around the world for cosmetic surgery. It is safe and produces immediate results that are esthetically pleasing and get better over time. Over the past two decades, it has grown from a procedure that facilitates small or spot reductions to one that has become an almost irreplaceable tool in the esthetic surgery armamentarium in neck, breast, and circumferential body contouring. Results from all liposuction and liposculpture procedures are noticeable immediately but they continue to improve for 6 months after the procedure. Suction-assisted lipectomy, lipoplasty, or more commonly referred to as liposuction, originally introduced by Illouz in the early 1980s, continues to be one of the most popular means of body contouring and overall treatment modalities offered in esthetic surgery today.^[1] A number of important innovations and modifications to the standard suction-assisted liposuction (SAL) have progressively refined the procedure; these include: The use of wetting solutions; advances in cannula design; ultrasound-assisted liposuction (UAL); power-assisted liposuction (PAL); VASER-assisted liposuction (VASER), and LASER-assisted liposuction (LAL). This article reviews the literature and discussed about indications techniques of liposuction.

INDICATIONS

Following are the common indications of liposuction:

- i. Obesity with lower limb arthritis
- ii. Obesity and metabolic syndrome
- iii. Lipedema and lipodystrophy syndrome
- iv. Multiple symmetric lipomatosis (Madelung disease Or Launois-Bensaude syndrome)

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- v. Insulin-induced lipohypertrophy and HIV associated cervicodorsal lipodystrophy
- vi. Lipoma
- vii. Gynecomastia, macromastia, and gigantomastia
- viii. Dercum disease
- ix. Lymphangioma and cystic lymphangioma
- x. Esthetically body disfigurement.

PATIENT SELECTION AND PRECAUTIONS

Following precautions should be remembered while selecting the patient for liposuction:

- i. To identify patients safely and to select the procedure that will yield the greatest outcomes, body mass index (BMI) is one of the most important considerations. To do body contouring and liposuction, a BMI of 30 kg/m² or below is required.
- ii. The patients are classified as ASA I–II by the American Society of Anaesthetists.
- iii. Smoking cessation is required 4 weeks before surgery and 3 weeks following surgery.
- iv. Anti-inflammatory medications must be stopped 48–72 h before surgery.
- v. Before surgery, surgeon should advise patients to cease use of herbal supplements since they pose risk of bleeding.
- vi. Any hormone replacement therapy should not be started until 3 weeks after surgery, and the combined contraceptive pill is ceased 4–6 weeks before surgery.
- vii. Pre-operative ultrasonography examinations are performed on all patients having abdominal contouring surgery.
- viii. In addition to the intraoperative compression garments, thromboembolism deterrent stockings are worn in all situations to lower the risk of deep vein thrombosis.
- ix. Low molecular weight heparin is utilized during lengthy procedures until the patient becomes fully mobile.
- x. All liposuction patients are fitted with seamless compression garments, but when three-dimensional, high definition liposculpture (HDL) is planned then add adequate soft padding to assist keep the contouring in the areas where it was initially created. The pressure garments are to be worn for 4–6 weeks.
- xi. In addition, the patients should receive manual lymphatic drainage for the first 3 weeks following surgery.
- xii. In cases of large volume lipoaspiration, it mandatory to monitor urine output for the first 24 h.
- xiii. It is better to administer one gram of tranexamic acid intravenously 30 min before surgery and 4 h after induction to lessen post-operative bleeding, bruising, and potential hematomas with total dose of 2–3 g/day.
- xiv. One should limit the lipoaspirate volume to 5 l each session.

TYPES OF INFILTRATION TECHNIQUES

There are four types of infiltration techniques:

Dry technique

In 1983, Fournier introduced the no infiltration (dry) liposuction method; however, the method has lost favor as a result of the considerable amount of blood loss in the lipoaspirate, which can range from 20% to 40%.^[2]

Moist technique

Illouz's method entailed injecting 200–300 cc of infusate fluid, regardless of the amount that needed to be aspirated. About 8–10% of less blood loss was reported during lipoaspiration than previously reported wet technique advanced by adding epinephrine which further lowers the blood loss to 4–8% in the infranatant of the lipoaspirate due to vasoconstriction of the vessels.^[3]

Superwet technique

The superwet approach, as described by Fodor in 1986, includes infusing 1 cc of infusion fluid for 1.5 cc of lipoaspiration. Due to this approach, only 1% of blood loss was reported during lipoaspiration.^[4]

Tumescent technique

The tumescent technique was introduced by dermatologist Klein and achieved significant improvements in the day-care surgery for liposuction and liposculpture, including high-definition body sculpture. The tumescent approach became more popularized in the 1990s. The tumescent infiltration method, which uses the skin's turgor and its change to white as end points on the volume injected in the area of liposculpture, allows for more volumes to be eliminated than with conventional wetting agents. The ratio of infusate to lipoaspirate is typically 2–3:1. It is prepared by combining 50 cc of 1% of lidocaine injected added to 1 l of normal saline with 1 cc of 1:1000 adrenaline and 10 cc of 8.4% of sodium bicarbonate solution (which lowers the discomfort). Normal saline has a pH of 5, but by adding bicarbonate, it lessens the acidity and reduces the amount of lidocaine that is available for absorption.^[4] As a result, large amounts of diluted lidocaine with a concentration up to 35 mg/kg can be injected into the site of liposuction with maximum dose of 7 mg/kg avoiding the complication due to drug toxicity. The additional benefit is reduction in intravenous fluid replacement.^[5] It is crucial to consider the anticipated volume when aspirating fat. Overall, tumescent technique reduces the fluid burden, lowers the danger of local anesthetic toxicity, and limits the infusate to not more than 4–5 l for 4 l of lipoaspiration. For every milliliter of aspirated fat, one must replace with 2 ml of fluid within the first 24 h when infusing or aspirating significant volumes, such as 3 l or more. For instance, it is expected that 20% of the injected fluid will be eliminated with the lipoaspirate in a scenario where 3 l of

fluid are injected and 3 l are aspirated. This will leave 2.4 l in the extracellular space, necessitating a 3.6 l replenishment of fluid volume over the course of the 1st day.

TYPES OF LIPOSUCTION TECHNIQUES

There are four types of liposuction techniques:

1. Mechanical liposuction
2. Syringe assisted liposuction (SaL)
3. PAL
4. Energy delivered liposuction (EDL)
 - a. LASER liposuction (LL)
 - b. VASER liposuction (VL).

Although embracing new technology is essential, the appropriate training must also be provided for patient safety at all times. Surgeons must continuously work to improve toward safety and clinical competence. Choosing of a liposuction technique depends on what the patient and the surgeon want to accomplish and then choose the appropriate technology from traditional mechanical liposuction to energy delivery liposuction. Traditional SaL with thin cannulas is preferred for small locations such as submental fat removal. When it comes to debulking and three-dimensional liposuction, one should favor combining VASER and a power assisted devices for a safe, time efficient, and better body contouring cosmetic outcomes.

A significant portion of patients can undergo liposuction under local anesthesia, with or without sedation with advantage reducing the hazards associated with general anesthesia while maintaining a high degree of safety and early recovery. Hartmann's solution is an alternative to normal saline for the infusion mixture because it is less acidic and has less sodium load, which lowers fluid overload in big volume liposuction. The end point of liposuction of suction/power assisted and UAL is shown in [Table 1].

Mechanical liposuction (SAL)

In the 1980s and 1990s, three distinct types of mechanical liposuction were first developed. A typical procedure for liposuction that uses a blunt and small cannula attached to a pressured vacuum pump is known as suction assisted liposuction (SAL). Cannulas of different sizes and diameter

available for liposuction are shown in [Figure 1]. A tiny incision is used to inject fluids and a cannula is subsequently placed to collect fat using a high-pressure vacuum connected with silicone or polyvinyl chloride suction tubing.^[6] The suction pump has two distinct values: Maximum vacuum and maximum flow rate. The canisters can be reused or discarded and they come in several sizes ranging from 250 ml to 3000 ml. There are several different types of reusable suction cannulas available.^[6] The type of anesthesia used will depend on the area that needs to be treated. Compared to SaL, the surgeon can remove fat more rapidly and with less effort, but there is a danger that blood vessels and nerves could be harmed. Although SaL can get rid of surface fat, the risk to the skin's blood supply is greater. The risks associated with this surgery include the potential for bruising and a longer recovery period.

Syringe assisted liposuction

Blunt cannulas and syringe-generated negative pressure are used in the operation known as SaL to remove fat [Figure 2].

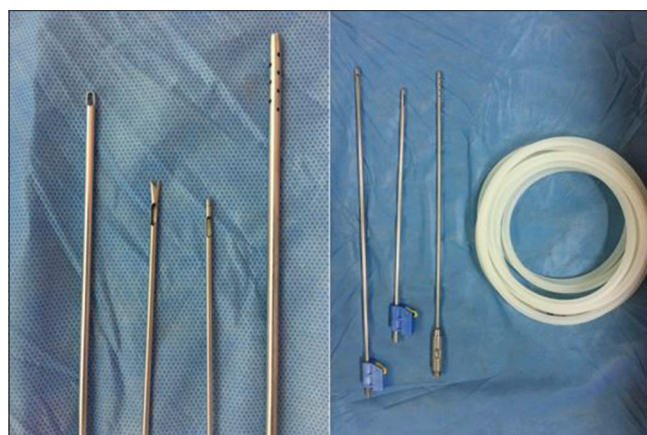


Figure 1: Liposuction cannulas for mechanical liposuction.



Figure 2: Syringe suction-assisted liposuction.

Table 1: Endpoints for liposuction.

Endpoint	UAL	SAL/PAL
Primary	Loss of tissue resistance	Final contour
	Blood aspirate	Symmetrical Pinch test results
Secondary	Treatment time	Treatment time
	Treatment volume	Treatment volume

UAL: Ultrasound-assisted liposuction, SAL: Suction-assisted liposuction, PAL: Power-assisted liposuction

The surgeon can use the syringe method to treat large areas slowly and laboriously. It is advisable to use it in treating small areas as a result.^[7] One of its advantages is that it can be done under local anesthesia as an outpatient surgery or as a day case. The syringe method has a number of shortcomings while being a safe operation. These challenges include the inability to remove surface fat as well as the challenge of managing post-liposuction resistance brought on by scar tissue.

PAL

PAL aspirates fat using cannulas that move either in circles or quickly back and forth. Due to the mechanical cannula's small incision and expedited fat extraction, less effort is needed during surgery.^[8] PAL was becoming more and more popular for body contouring and fat removal procedures [Figure 3]. The vibrating cannula used in the fat extraction process makes it easier and less difficult to extract more fibrous fat.^[9] Power aided liposuction has increased the surgeon's skill, particularly in huge volume liposuction, fibrous areas, and secondary treatments utilizing more superficial tissue planes. Reduced fatigue and time spent by the surgeons during the procedure expedites the removal of fat and yields remarkable outcomes for patients seeking body contouring. Other advantages of PAL include less edema, a quicker recovery, and decreased intraoperative pain. Compared to SaL and suction-assisted liposuction, fat harvesting is 45% faster.^[10] Another advantage of PAL is the use of the self-contained tank and the tubing system, which guarantees cleanliness. The method as a whole is latex-free, and the fat retrieved is practically colorless and less bloody than that obtained through manual liposuction, making it suitable for fat transfer.^[11] In conclusion, aspirating fat from diverse body parts using the PAL system is practical, completely sterile, and time-efficient. Other body parts may also receive this fat. In addition, donor site morbidity is reduced, making the procedure safer for the patient and less taxing on the surgeon.



Figure 3: Power-assisted liposuction machine.

EDL

Both the life of the surgeon and the patient has been altered by the power-assisted liposculpture revolution. Two energy delivery technologies have been created and put on the market in the past 20 years.

LL

Laser lipolysis technology gained popularity when studies on the relationship between the laser and adipose tissue were conducted.^[12] LAL is one of the most advanced treatments for adipose tissue anomalies and lipodystrophies. The laser beam preferentially targets adipose tissue when in close proximity to it. Laser activity causes the adipocyte membrane to rupture, releasing the greasy substance into the extracellular fluid. As a result of the reticular dermis being reorganized, neo-collagen can grow and remodel.^[13,14] When comparing laser technology to conventional liposuction and other energy-delivery methods, there are benefits and drawbacks to consider. The most frequent benefit is the patient's speedy recovery. Due to the liquefaction of the fat and the small size of the laser probe, less effort on the part of the surgeon was needed to melt and remove the fat. When treating small areas such as the submental, knees, or thighs, some surgeons opt not to aspirate the melted fat, further minimizing direct tissue injury. A key benefit observed in the early post-operative stage is the skin tightening related with laser energy delivery.^[15,16] The inability to transfer the extracted fat after LAL is a drawback. Laser use has also been linked to reports of skin burns.

VL

VASER energy delivery technology, the surgeon was able to melt and remove a significant quantity of fat, even the superficial fat layer, leaving the body with finely defined muscles throughout abdomen, back, arms, and legs by ultrasound [Figure 4]. It is crucial to refrain from over-removing fat and leave 1 cm of fat thickness in the deep dermis to avoid deep tissue scarring and anomalies.^[17,18] By presenting a novel method for body contouring, Colombian cosmetic surgeon Alferdo Hoyos significantly enhanced



Figure 4: Ultrasonic liposuction machine.

the VASER liposculpture procedure. The technique's name was HDL. In contrast to basic liposuction or fat removal, Dr. Hoyos' treatment is an esthetic approach to contouring the body and defining the surface anatomy. VASER body sculpture technology gives the doctor the ability to use it as a sculpting tool to produce the ideal profile,^[19] going much beyond the straightforward fat removal of fatty bulges. Excellent cosmetic outcomes are made possible with less injury to the blood vessels and soft tissue with VASER-assisted liposuction. HDL breaks down the fat and makes it ready for the surgeon to delicately sculpt the muscle structure using aspiration, which is not possible with conventional liposuction.^[20-22] Compared to normal liposuction, the VASER technique may be more challenging and time-consuming. It is important to keep in mind that VASER technology or laser technology adds one extra stage to traditional liposuction that is emulsification of fat. However, another phase that is included in three-dimensional sculpting is the elimination of the superficial fat.^[23] The fat is debulked with less trauma when VASER is combined with power aided liposculpture devices. The VASER and HDL approach may be more difficult and time-consuming than standard liposuction.^[24,25] However, the removal of the superficial fat is a further stage of three-dimensional sculpting.

As a result, we advise that it be carried out by an experienced team or, if possible, by multiple teams working together. An experienced team or team's increases safety, shortens surgery, lessens surgeon fatigue, and improves patient outcomes. To get the best results from any of the approaches mentioned in the sections above, it is essential to remember that the patient's choice is just as important as the surgeon's training and experience.

CONCLUSION

Liposuction, body contouring, and three-dimensional sculpture surgeons are a self-selecting group who aspire to achieve excellence. This is a commonality shared with artists who create three dimensional figurines. It is important not to be bogged by the different names given to three-dimensional sculpturing of a human figure; however, the emphasis should be put on patient selection, safety, developing, and refining skills. Embracing new advances in technology, is important, however, must come with appropriate training keeping patient safety at all times.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Chittoria RK, Singh PB. Indications and techniques of liposuction. *CosmoDerma* 2022;2:109.