ASERNIP-S

Australian Safety and Efficacy Register of New Interventional Procedures – Surgical

Consumer Summary

Ultrasound-assisted Lipoplasty (Update)

(Adapted from the report of the Review Group for consumer use by Ms D. DeNichilo)

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The intent of this review by ASERNIP-S was to systematically review the medical literature regarding the procedure of ultrasound-assisted lipoplasty for the recontouring or sculpturing of body shape with respect to its safety and effectiveness. In addition to the findings of the review and the recommendations made by ASERNIP-S to the Royal Australasian College of Surgeons, some background information on the distribution and composition of adipose or fatty tissue has been provided.

What is lipoplasty?

Lipoplasty is a surgical technique for the permanent removal of undesirable and/or excessive fat deposits located beneath the surface of the skin and the remodeling of body contours or shape. It is usually applied to the hips, outer thighs, abdomen, buttocks, front of the neck, waist, knees, calves and ankles. Other terms for lipoplasty include liposculpture, liposuction or suction lipectomy. The definition of "undesirable" and

"excessive" body fat is subjective and will vary across patients and/or treating surgeons. It is important to note that lipoplasty is not an effective substitute for weight loss. Its use should be restricted to the removal of fat deposits which have failed to respond to diet and exercise. Patients should be in good health and have a stable weight prior to undergoing lipoplasty. While the fat that is removed is done so permanently, lipoplasty does not prevent weight gain in the future. The remaining fat cells can increase in size if weight is gained after liposuction, however, this increase will occur proportionately, so that the new sculptured body contour is preserved.

The role of fat in the body

It is normal for the body to contain stores of fat. A healthy percentage of body fat in women is up to 30% and in men up to 25%. Women generally have a higher percentage of total body fat than men do, in what appears to be a universal phenomenon. Women tend to store fat in the lower trunk, hips, upper thighs and buttocks. This distribution gives the majority of women a "pear" shape. Men on the other hand, tend to accumulate fat more evenly around the trunk, hence the increased abdominal girth or width, with a thick torso and upper abdomen, giving them the typical "apple" shape. As we age, the proportion of fat around the trunk increases and fat under the skin in the extremities tends to shift to both within and between the muscles over time.

Fat tissue serves several important functions. It acts as an insulator against the cold and confers protection to several of our vital internal organs by providing a cushioning layer. Fat cells are an important source of energy, for when fat is metabolised it generates energy. Generally, as adults get "fatter", the fat cells get larger while the number of fat cells remains constant. In some forms of obesity (30% above ideal body weight), the fat cells can increase in number to accommodate the excessive fat storage requirement. This form of obesity is far less common than the type described above and does not respond readily to diet and exercise.

Who is a candidate for lipoplasty?

Not everyone is a candidate for lipoplasty. Unless the patient has good skin elasticity that can accommodate the reduced contour or curve of the body by shrinking to 'fit' the new shape created by the surgeon, lipoplasty is not recommended. The most dramatic changes to body shape are achieved in patients who have localised areas of protruding fat.

Lipoplasty is not recommended in those who have an unstable weight (gaining or losing) history, a significant medical history that would make any discretionary cosmetic procedure unsuitable and for those with unrealistic expectations.

The history of lipoplasty

Body contour surgery was first made possible by the invention of anaesthesia in 1846, but it was not until 1880 that it was commonly employed in association with hernia repair for the cosmetic removal of fat. During the next century, the basic techniques of body contour surgery remained unchanged. In 1969 and 1970 advancements in surgical techniques were made that substantially increased the surgical options in this field, however, the most profound development without doubt was liposuction.

Suction-Assisted Lipoplasty - the traditional approach

Lipoplasty, put simply, is the surgical 'vacuuming' of fat beneath the surface of the skin. The fat cells that largely make up body fat are 'sucked' out along with associated body fluid in volumes varying from several hundred millilitres to several litres. The vacuuming of the fat cells is performed using a cannula (a thin, hollow tube). The cannula, which is inserted beneath the skin, is connected to a power source that generates sufficient suction to remove the fat without causing significant damage to the nerves and blood vessels that criss-cross the fatty tissue. This traditional approach to lipoplasty is known as suction-assisted lipoplasty (SAL). This is a widely practiced technique with low complication rates (refer to section: "How safe is Suction-Assisted Lipoplasty (SAL)?") and high levels of satisfaction among patients.

The technique of SAL has evolved over time following the introduction of modifications and refinements to make it easier to remove fat and minimise the damage caused. The earlier cannulae for example, were sharp-tipped and capable of indiscriminately damaging the nerves associated with blood vessels. Suction pressure has also been reduced to one atmosphere, providing sufficient negative pressure to suck out disrupted fat globules, while minimising the risk of damage to vital structures.

Fat tissue is composed of fat storage cells held together in a matrix of fibrous tissue. When fat is removed in lipoplasty, fluids are also vacuumed out in addition to the accompanying electrolytes. A yellowish opaque fluid referred to as a fatty emulsion is extracted. The removal of volumes greater than four litres is referred to as high volume lipoplasty.

The 'dry' versus the 'wet' technique

When lipoplasty first emerged, it was performed using the 'dry' method. The technique was described as 'dry' because no fluids were pumped into the tissues to be liposuctioned. This rather brutal procedure in which fat under the skin is virtually ripped out with the assistance of external massage, leads to significant bleeding.

To reduce the bleeding and complications associated with the removal of rather large volumes of fluid, the 'wet' method was introduced. In this method, various wetting solutions are injected under the skin prior to suctioning. These solutions contain a salt solution at an isotonic concentration, combined with a local anaesthetic and adrenaline. The anaesthetic is present to minimise discomfort from pain and the adrenaline to temporarily close the capillaries to minimise bleeding.

The 'wet' techniques

The 'wet' approach uses 200 - 300mL of an isotonic salt solution, usually combined with adrenaline in a low dose. This solution is infused under the skin of each site to be liposuctioned, regardless of the volume to be removed.

In the ‘superwet’ technique, the volume of the wetting solution matches the proposed volume to be removed. If for example, five litres of fatty tissue is to be removed, then five litres of the wetting solution is used. The isotonic solution used (e.g. Ringer’s lactate) contains adrenaline in a low dose. As this type of liposuction is usually performed under general anaesthesia, local anaesthetic is not included in the wetting solution.

Finally, there is the ‘tumescent’ technique in which the wetting solution serves as the primary means by which anaesthesia is given, in the form of large amounts of the local anaesthetic lignocaine. The wetting solution is pumped into the tissues in which liposuction will be performed until they swell, enabling passage of the cannula with less pain, trauma and bleeding. The use of injected fluid under the skin is claimed to prevent the massive shifts of fluids out of the blood vessels usually observed in liposuction under general anaesthesia. With tumescence under local anaesthetic, only small amounts of intravenous (IV) fluid may be advisable.

It is important for the surgeon to monitor the fluid and lignocaine load of the tumescent technique, as lignocaine toxicity can occur particularly when the wetting solution is combined with Sedative anaesthetic agents(e.g. midazolam). However, large doses of lignocaine under local anaesthetichave been used successfully in tumescent anaesthesia without signs of toxicity. This may be explained by the observation that lignocaine tends to get incorporated in the fat tissue as evidenced by its presence in the fatty emulsion that is removed in liposuction. However, caution should be exercised by the surgeon because lignocaine levels may reach peak levels in the blood as late as several hours after infusion of the wetting solution.

There has been considerable debate as to the safest composition of the tumescent formula, particularly in UAL, which is usually performed with the tumescent technique. The complete version of this review provides recommendations as to the desired components and their concentrations and guidelines for their use.

How safe is Suction-Assisted Lipoplasty (SAL)?

As with any surgical intervention, SAL is associated with potential complications. Nevertheless, through careful patient selection, sensible choice of wetting solution, careful operator technique, restriction of fat removal to modest volumes of tissue and appropriate aftercare, the complications from SAL can be limited to those that are predictable as outlined below.

Anaesthesia-related complications include lignocaine toxicity and shock caused by the depletion of blood volume referred to as hypovolaemic shock. Scarring, contour defects, the loss of skin and sensation, the risk of haematomas, seromas and pain do occur. The rate of these complications can be related to the skill of the operator. General complications include swelling, bruising, impaired physical activity, infection, fat emboli and thrombus emboli.

Ultrasound-Assisted Lipoplasty (UAL)

The introduction of ultrasound-assisted lipoplasty (UAL) into surgical practice has been relatively recent for Australasian surgeons, following its generally positive introduction within Europe and the United States of America.

Ultrasound-assisted lipoplasty utilises pre-existing technology, namely, the use of ultrasonic energy, to disrupt fat tissue. Former surgical applications include phaco-emulsification of cataracts, ultrasonic removal of tumours within the skull and applications in liver and kidney surgery. In UAL, ultrasonic energy is applied under the skin of fatty tissue to fragment the fat cells and assist in the removal of fat in a liquid form. The fat is removed in the same manner as for SAL. This review will focus on the techniques that deliver ultrasonic energy internally, although it is possible to utilise external ultrasonic energy over the skin, prior to extraction of fat via the cannula.

Popular in Europe and South America for over a decade since its introduction by an Italian, Zocchi, UAL has only gained popularity elsewhere in recent times. An independent report prepared by the Environ Corporation in 1996 on behalf of one of the

device companies in the USA made several positive claims about UAL. This report claimed that the use of this technique resulted in less injury to nerves and blood vessels, less overall tissue trauma, minimal blood loss, a smaller diameter of channels and smooth tunnels formed in fat tissue, more even shaping of overlying skin surfaces, accurate positioning of the probe, and spot-specific tissue removal. The disadvantages reported to be associated with UAL over SAL include greater operating room time, more expensive equipment, the potential for permanent damage to the skin and fat, burns, scarring, hyperpigmentation and a loss of sensation. Additionally, there was a longer learning curve for surgeons to acquire an acceptable skill level when using this technique.

How is Ultrasound-Assisted Lipoplasty performed?

Electric current (standard wall socket voltage of 240W) is converted into high frequency sound waves, which are transformed into mechanical vibrations by a hand piece attached to a probe. The surgeon inserts the probe under the skin through an incision into the area from which the excessive fat is to be removed. The amount of energy applied is controlled through the hand piece. The vibrating probe is ultimately responsible for rupturing the fat cells, a process referred to as cavitation which effectively "emulsifies" the fat cells. The resultant fluid is composed of fatty acids, the fluid found in the gaps between organs and cellular structural elements of tissues, known as the interstitial fluid, and the wetting solution described above.

The probe described above can be either solid or hollow in design. The use of a solid probe results in the steady accumulation of the emulsified fat under the skin. The removal of the fatty emulsion requires the insertion of a separate hollow cannula to suck it out as with SAL. The use of a hollow probe however, allows low-pressure suction to simultaneously remove most of the emulsion during the application of ultrasonic energy. Complete removal of any remaining emulsion relies on the use of standard cannulae.

Is ultrasound-assisted lipoplasty safe and effective?

Ultrasound-assisted lipoplasty has been shown to be beneficial in the contouring of fibrous areas such as the back, sacrum, enlarged male breasts and in scar tissue from

previously attempted liposuction. Ultrasound-assisted lipoplasty is not considered a substitute for SAL, but rather a supplementary procedure for use in fibrous areas.

The precise way in which ultrasonic energy interacts with living tissue is only partially understood. An incomplete understanding of this interaction accounts for the reluctance among some clinicians to fully embrace this technology. It is known that the interaction of ultrasound with human tissues in the body produces three different effects:

1) thermal;
2) cavitational; and
3) direct tissue interactions.

Thermal Effects

Thermal effects refer to the capacity of ultrasonic energy to heat the tissue to be liposuctioned. The absorption of ultrasonic energy in human tissue depends on the composition of that tissue. For water and body fluids, there is little absorption of heat in the conditions generated under ultrasound, so there is little risk of heating. The tumescent conditions under which UAL is performed create an essentially fluid medium, therefore in theory, little absorption and heat gain should occur. The extent of tissue heating by ultrasound depends however, on the balance between heat gain and heat loss. The passage of heat through fatty tissue is poor, so that loss of heat may be limited. The net effect may be tissue overheating which can result in burns. Skin injuries can occur as a result of inadequate flow of blood to the skin. Particular care must be taken by the surgeon when treating areas of fat bounded by tendon-like connective tissue as this tissue has a greater tendency to absorb ultrasonic energy.

A study in which temperatures under the skin of the area undergoing liposuction were measured, before, and at intervals after the infusion of tumescent fluid, has shown that temperatures under the skin do rise with the application of ultrasonic energy. The average temperatures under the skin, however, remain below the body's core temperature (37°C). The recommendations from this study were that tumescent fluid at room temperature should be used and that only experienced operators should perform UAL.

Cavitational Effects

The application of ultrasonic energy to the body's tissues results in a phenomenon known as cavitation - the generation, growth and collapse of gas bubbles in a sound field. In a sound field, sound waves are generated by vibrations through a medium, whether it is gas, liquid or solid. Studies with simple liquids and cell suspensions have shown the vibrations emitted by the hand piece used by the surgeon during UAL, produce a series of varying pressure changes in the bubbles of dissolved gas within the fat tissue causing them to grow and shrink. When the pressure changes are sufficiently large however, the forces can be large enough to fragment fat cells. At higher vibrations, a more violent form of cavitation causes the sudden, violent collapse of gas bubbles generating locally intense shock waves with the release of dramatic amounts of heat and pressure.

Unfortunately, little is known about the effects of cavitation in human tissue. It is known from cell culture experiments however, that cavitational effects can result in sufficient energy to disrupt chemical bonds and produce free radicals. These highly chemically reactive compounds are capable of damaging DNA, protein and the fat in cell membranes. They may potentially lead to chromosomal damage, although it would appear that this has never been investigated in either patients or laboratory animals to our knowledge.

Direct Tissue Interactions

The physical effects of UAL on fat tissue have been investigated through the microscopic examination of the tissue removed following SAL and UAL in a small number of patients. The tissue derived from SAL was found to be composed of fat cells in their original organised form, whereas the tissue derived from UAL showed cells ruptured at several sites and all the junctions between cells destroyed. No evidence of the cavitation phenomenon was noted.

The Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP-S) recommends that it is inadvisable to use UAL to contour breast tissue. The

concern is that cancer of the breast that has not yet spread locally or remotely could do so. The absence of knowledge regarding the long-term ultrasonic effects on fat and breast tissue has provoked such caution.

The complications of UAL are addressed below under 'Informed Consent'.

Recommendations

Training Requirements

To be safe and effective, UAL should be performed by a suitably qualified practitioner. While the USA has set an obligatory training program for surgeons intending to perform UAL, in Australia there is currently no such requirement for advanced surgical trainees and accredited surgeons. The ASERNIP-S Review Surgeon supports the introduction of a training program comparable to that used in the USA, which stipulates attendance at a series of lectures and a laboratory component.

Suitable candidates for UAL

The selection of patients for any liposuction procedure should be confined to those in good health and close to their ideal body weight. Furthermore, liposuction should be restricted to specific areas of excess fat that have not responded to diet or exercise.

Ultrasound-assisted lipoplasty can be used as a complementary procedure to SAL in fibrous tissue, particularly the back, sacrum and on enlarged male breasts, but should be avoided in female breast tissue and in pregnant women.

Informed Consent

It is imperative that patients are well informed about the risks associated with liposuction in general and specifically with SAL and UAL, particularly if UAL is to be used to complement SAL. Some risks are common to both techniques, and some are unique to each technique.

The risk of injury including thermal injury or burns, permanent damage to the skin, seromas, nerve damage, skin scarring, bruising and postoperative pain should be explained preoperatively. Suboptimal cosmetic outcomes such as contour defects need explanation. Difficulties that may be encountered on account of the nature of the procedure, namely, wetting solution-related problems, ultrasound-induced biological effects and anaesthetic-related problems should also be covered.

Essentially, the risks of injury include:

- incision site burns from friction
- ultrasound-induced burns
- the accidental touching of skin around the areas to be lipoplastied with the probe, referred to as dermal 'end-hits'
- skin loss due to high temperatures or inadequate blood supply
- fat liquefaction and the formation of cavities
- diminished sensitivity of a part of the body
- impairment of touch sensation
- significant bruising and pain
- long-term staining of the skin by haemosiderin
- longer incisions for UAL (compared to SAL) to accommodate the use of a skin protector

Precautions the surgeon can take to reduce these risks include:

- the use of skin protectors to overcome skin burns at the site of incisions
- using an adequate volume of wetting solution
- cannula tip control with constant movement
- limiting the time of exposure to ultrasonic energy
- lower amplitude settings to reduce the vibrations of the probe
- thorough removal of the fatty emulsion
- insertion of wound drains in large volume lipoplasties (>1.5 litres)

- conservative liposuction in areas of marked skin looseness
- appropriate compression garments postoperatively
- avoiding prolonged superficial treatments that remove fat very close to the skin
- advising patients that by ten weeks, 90% of liposuction patients will have normal sensation
- adequate and regular oral analgesia
- careful placement of incisions
- meticulous skin closure and scar management

The risk of contour irregularities include: the uneven skin contours from insufficient removal of the fatty emulsion and the grooving or tunnelling defects from over enthusiastic removal in areas where the fatty tissue is close to the skin. These risks can be reduced by the use of: accurate markings preoperatively; use of adequate wetting solutions; attention to liposculpting technique; and avoidance of aggressive treatment close to the skin surface.

The risks pertaining to the wetting solutions include: shock; fluid overload; lignocaine toxicity; adrenaline overdose; electrolyte imbalances; hypothermia; and death from a combination of these risks. The pertinent precautions relate to the rate at which lignocaine is infused, the use of physiological solutions, the concentration of adrenaline, the use of wetting solutions at room temperature and safe fluid resuscitation practice.

The risks associated with how ultrasonic energy interacts with living tissue were noted earlier. It is prudent to avoid prolonged exposures to ultrasonic energy in one location, to use UAL only as a supplement to SAL, to exclude pregnancy and to avoid female breast contouring with UAL.

It is recommended that: a specialist anaesthetist with experience in anaesthesia for liposuction patients is in attendance; appropriate monitoring and resuscitation equipment is available; formal agreements between day surgeries and major centres for transfer in

case of emergency are in place; the surgeon has a thorough understanding of the fluid shifts with various types of anaesthesia; and appropriate patient positioning is used.

Documentation

The ASERNIP-S Review Surgeon recommends that in addition to preoperative and postoperative photographs, clinical examination data and operative details should be recorded accurately with worksheets. It has further been suggested that maintaining a record of fluid loss from each zone of the body during surgery, is a useful means of gauging blood loss.

Conclusion

In conclusion, the technical aspects of UAL can be carried out safely if certain fundamental principles are observed:

- appropriate patient selection
- appropriate body sites
- attention to operative technique
- careful selection of wetting solutions
- adequate fluid management
- good patient monitoring and documentation
- postoperative compression garments

The need for future research

While UAL appears to be a technically safe and effective procedure, there remains the persisting doubt about **potential hazards long-term, as a result of the high-energy interactions with tissue**. Future studies could be undertaken in an animal model in which there is a high predisposition to develop chromosomal abnormalities in response to external factors. Exposure to ultrasonic energy as used in UAL could be followed by an analysis of any chromosomal alterations to determine whether the UAL-treated group had more DNA damage when compared with animals in a control group not exposed to UAL. The importance of undertaking such a study is based on the uncertainty of the

significance of the ultrasonic tissue effects, particularly at the levels delivered to human tissue with UAL.

Procedure Classification

The safety and efficacy of the procedure cannot be determined due to an incomplete and/or poor quality evidence-base. An audit is required.

Evidence Update – Year 2000

An update of the information available on ultrasound-assisted lipoplasty was undertaken by ASERNIP-S in July 2000. Based on the updated evidence it was found that the original recommendations made by the Royal Australasian College of Surgeons for the use of this technique should remain the same. In addition, it was stressed that the potential for DNA damage should be investigated with appropriate *in vivo* (living) animal models before the procedure's safety and efficacy can be determined.

Acknowledgments

www.lipoinfo.com/

Redwood Editions 1998, Dictionary of Science, Dingley, Australia

HarperCollins Publishers 1999 (Second Ed.), Dictionary of Medicine, Glasgow, Scotland

Key words: ultrasound lipoplasty, ultrasound liposuction, ultrasound lipectomy

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Important Note: The information contained in this report is a distillation of the best available evidence located at the time the searches were completed as stated in the protocol. Please consult with your medical practitioner if you have further questions relating to the information provided, as the clinical context may vary from patient to patient.

For further information about ASERNIP-S
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If you would like to provide feedback on this consumer summary, please contact us at consumer.asernip@surgeons.org .

ASERNIP-S is a programme of the Royal Australasian College of Surgeons (RACS).

Glossary

Abdomen: the part of the trunk below the chest.

Accredited surgeons: surgeons who have completed the prescribed period of training in approved programs and who have passed the examinations are accepted by the Royal Australasian College of Surgeons (RACS) Council as Fellows of RACS and as such are recognised as fully qualified surgeons. Fellowship of the College leads to automatic registration by the various registering authorities as a specialist surgeon in the relevant field of surgery.

Adrenaline: a hormone secreted by the inner parts of the adrenal glands. It is produced when unusual efforts are required. It speeds up the heart, increases the rate and ease of breathing, raises the blood pressure, deflects blood from the digestive system to the muscles, mobilises the fuel glucose and causes a sense of alertness and excitement. Adrenaline is available for use as a drug.

Advanced surgical trainees: doctors who having completed the two year Basic Surgical Training program after the intern year, undertake an Advanced Surgical Training program offered by the Royal Australasian College of Surgeons, which extends over four or more years, depending on the specialty concerned. Advanced Surgical Training involves the application of surgical science appropriate to the Specialty as well as to the practice of surgery.

Amplitude: for sound waves, the amplitude relates to the intensity of the wave.

Anaesthesia: the loss of sensations of touch, pressure, pain or temperature in any part of, or in the whole of the body induced by drugs known as anaesthetics. Under general anaesthesia, loss of consciousness is also experienced.

Anaesthetic: a drug used to cause unconsciousness or insensitivity to pain.

Anaesthetist: a specially trained doctor who administers anaesthetics.

Atmosphere: a unit of pressure.

Audit: in surgical practice this refers to the process of measuring and monitoring the diagnosis, investigation, surgical treatment, resulting outcomes and follow-up of patients.

Cannula: a hollow surgical tube, into which is inserted a close-fitting, sharp-pointed inner stiffener called a trocar. This combination can easily be pushed through the skin or the lining of a blood vessel or other tissue. When in position, the trocar is pulled backwards out of the cannula, leaving the latter in place. Fluids or other materials may then be passed.

Cannulae: the plural of cannula.

Capillaries: the smallest and most numerous of all blood vessels. Capillaries form dense networks between the arteries and the veins.

Cavitation: the generation, growth and collapse of gas bubbles within tissue in a sound field.

Cell culture: the growing of cells on artificial media under ideal conditions for growth.

Chromosomal: pertaining to the chromosomes. Chromosomes are separate, coiled DNA and protein structures present in all animal and plant cells that carry the genetic code for the construction of the body or organism.

Connective tissue: loose or dense collections of collagen fibres and many cells, in a liquid, gelatinous or solid medium. Connective tissue features in the structure of organs or body tissue or binds them together. Includes cartilage, bone, tooth dentine and lymphoid tissue.

Control group: a group of individuals enrolled in a study which receive the standard procedure, as opposed to the experimental group which receive the procedure under investigation.

Cosmetic: serving to beautify.

Discretionary: Done for the convenience of a patient rather than for important issues of life or health. Most cosmetic surgical operations are considered discretionary.

DNA: (abbreviation for deoxyribonucleic acid) strands of material located in the nucleus or centre of a cell. These strands carry the genes which are responsible for all the characteristics of an organism and are passed from parents to offspring.

Electrolytes: compounds that dissolve in water to produce a solution that can conduct an electrical charge. The electrolytes in the fluids surrounding cells are mainly sodium, chloride and bicarbonate, whereas in the cell, there is mainly potassium, magnesium, sulphate and phosphate. The balance between these electrolytes is essential to life and is maintained through the active pumping action of the cell membrane.

Embolism: sudden blocking of an artery by solid, semisolid or gaseous material carried in the bloodstream to the site of the blockage. The object, or material, causing the embolism is called an embolus.

Emulsified: made into a liquid preparation of the colour and consistency of milk.

Emulsion: a uniform suspension of fat or oil particles in an aqueous continuous phase.

External ultrasonic energy: ultrasonic energy applied over the surface of the skin.

Fibrous: made of fibres.

Free radicals: highly chemically reactive compounds capable of damaging DNA, protein and the fat in cell membranes.

General anaesthesia: a state of unconsciousness and immobility brought about by drugs, so as to allow surgical operations or other physical procedures to be performed without pain or awareness.

Globules: small, rounded drops.

Haematoma: a bruise or collection of blood in a tissue.

Haemosiderin: one of the two forms in which iron is stored in the body.

Hernia repair: the surgical repair of an abnormal protrusion of an organ or tissue through an opening in its surrounding tissues. The surgery corrects the protrusion.

Hyperpigmentation: abnormally increased numbers of pigment cells (melanocytes) in a particular area of the body. This results in a darkening of the area.

Hyperthermia: a body temperature over 41.1°C. Normal: 37°C.

Hypothermia: below normal body temperature (37°C).

Hypovolaemic: an abnormal reduction in the circulating blood volume from any cause.

Ideal body weight: a recommended range of weight for adults according to height.

Incisions: cuts made with a scalpel.

Infusion: the introduction of a solution into a vein, artery or tissue.

Intravenous: into a vein.

Isotonic: pertaining to a solution containing just enough salt to prevent the destruction of red blood cells when added to blood.

Learning curve: a phenomenon that describes the improving skill of surgeons in performing a particular procedure after performing an increasing number of cases.

Lignocaine: a widely used drug, which may be given by injection or as a topical (on the skin) application to anesthetise a localised area of the body.

Lipoplasty: a surgical technique that uses suction to remove undesirable and/or excessive body fat located under the skin, from localised areas.

Local anaesthetic: an anaesthetic affecting only part of the body and not affecting consciousness. Local anaesthetics may be applied, usually by injection, directly to the part to be operated on, or may be applied, at a distance, to the sensory nerves coming from that part (nerve block).

Metabolised: subjected to the chemical process that breaks down energy sources or substrates (e.g. fat) to release energy.

Microscopic: so small as to be invisible or indistinct without the use of a microscope.

Midazolam: a benzodiazapine drug given by intravenous injection as a sedative for minor surgery or to induce general anaesthesia.

Necrosis: the structural changes that follow death of a body tissue.

Negative pressure: (suction) the force per unit area exerted at a given point.

Obesity: excessive energy storage in the form of fat, occurring when food intake exceeds the requirements for energy expenditure.

Oral analgesia: the lessening or removal of pain by an analgesic taken by mouth.

Phaco-emulsification of cataracts: a method of cataract surgery in which the opaque lens is broken up within its capsule into tiny particles by ultrasonic vibration of a fine probe inserted into the eye.

Physiologic: used to describe a normal body process or structure, to distinguish it from an abnormal or pathological feature.

Resuscitation: in the context of liposuction, this refers to the practice of replacing fluids intravenously when the shift of fluids out of the blood is massive, causing the patient to go into shock.

Ringer's lactate: a solution in water of salts of such concentration as to be isotonic to blood and tissues.

Sacrum: the large, triangular, web-shaped bone that forms the centre of the back of the pelvis and the lower part of the spine.

Saline: a solution of salt (sodium chloride) in water. Normal saline is a solution with the same concentration of salt as body fluids and is suitable for infusion into a vein (0.9%). Also known as physiological saline.

Sedative anaesthetic agents: drugs that have a sedating affect.

Seromas: persistent fluid collections under the skin that occur most commonly in the abdominal area, especially after the removal of large amounts of fat. Seromas may be present in up to 10% of patients.

Skin protector: a small device made of plastic which "screws into" the incision at the site of lipoplasty, and connects with the shaft of the probe as it is moved in and out of the tissue. The device protects the surrounding skin from burns.

Thrombus: a blood clot forming, especially on the wall of a blood vessel. This is commonly the result of local damage to the inner lining of the vessel.

Tissues: an aggregation of joined cells and their connections that perform a particular function.

Torso: the trunk of the human body.

Toxicity: the quality or degree of the effect of a poison.

Tumescent: swollen or ballooned.

Ultrasound-assisted: the use of ultrasonic energy in conjunction with another intervention.

Ultrasonic energy: the energy derived from mechanical vibrations of frequencies above the human limit of hearing (over 16kHz). Ultrasound can be generated and detected at frequencies exceeding 2000 MHz, but the range considered in medical and industrial practice has an upper limit at about 10MHz (diagnostic devises usually range between 900 kHz and 6 MHz). Note: 1KHz=1,000Hz and 1Mhz=1,000,000Hz.

Wetting solutions: the solutions pumped beneath the skin prior to liposuction, to assist in the removal of fatty tissue.