



Case of death by liposculpture: Medical opinion

Caso de muerte por lipoescultura: dictamen médico

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Keywords:

Liposuction, liposculpture, lipoinjection, fat infiltration, lipotransference, buttocks, complications, massive fat embolism, fatty embolism, toxic heart disease, cocaine and surgery.

Palabras clave:

Liposucción, lipoescultura, lipoaspiración, lipoinyección, infiltración de grasa, lipotransferencia, glúteos, complicaciones, embolia grasa masiva, embolismo graso, cardiopatía tóxica, cocaína y cirugía.

ABSTRACT

The alterations that occur prior to the sudden death of patients operated on liposuction are hypotension, bradycardia, oxygen desaturation and asystole. The causes are fatty embolism, anesthetic poisoning, and vagal reflex due to high epidural block and toxic heart disease due to cocaine use. In the last four years we have identified six cases in similar conditions; we present the expert opinion of one of them. A case of a 43-year-old woman addicted to cocaine with prior liposuction; body weight 65 kg and height 1.65 m. A liposuction of the abdomen, sides and back was performed, having used saline solution + 1 vial of adrenaline for vasoconstriction, 3,000 mL and 300 mL of fat infiltrate in each buttock was aspirated. A double epidural block with 3 doses of anesthetics was used. The third dose of anesthetics coincided with fatty infiltration. In this moment the patient presented hypotension, bradycardia and oxygen desaturation that in a few minutes evolved to asystole. She did not respond to resuscitation maneuvers. The forensic pathology study reported vacuoles compatible with fat and established fulminant massive fat embolism, the cause of death. There are several mortal nosological entities that can occur during a liposculpture, all have similar clinical manifestations. Severity depends on the way the patient responds and they are difficult to diagnose and treat. With the data obtained and the report of the forensic study, the cause of death cannot be determined categorically. Studies are needed to look for these pathologies to establish the true diagnosis.

RESUMEN

Las alteraciones previas que se presentan antes de la muerte súbita de aquellos pacientes que son operados de liposucción son: hipotensión, bradicardia, desaturación de oxígeno y asistolia. Las causas suelen ocurrir por embolia grasa, intoxicación por anestésicos, reflejo vagal, bloqueo epidural alto y por cardiopatía tóxica por consumo de cocaína. En los últimos cuatro años, hemos identificado seis casos en condiciones similares; en este trabajo, presentamos el dictamen experimentado en uno de ellos. Se trata del caso de una mujer de 43 años adicta a la cocaína y con una liposucción previa, peso corporal de 65 kg y una estatura de 1.65 m. A esta paciente le realizaron una liposucción del abdomen, costados y espalda; para ello, utilizaron solución salina más una ampollita de adrenalina para vasoconstricción; le aspiraron 3,000 mL e infiltraron 300 mL de grasa en cada glúteo. Para este procedimiento, utilizaron doble bloqueo epidural con aplicación de tres dosis de anestésicos, sin embargo, la tercera dosis de anestésicos coincidió con la infiltración de grasa, lo que al momento hizo que la paciente presentara hipotensión, bradicardia y desaturación de oxígeno, que en pocos minutos evolucionó a la asistolia. No respondió a las maniobras de resucitación. El estudio de patología forense reportó vacuolas compatibles con grasa y determinó una embolia grasa masiva fulminante como causa de muerte. Son varias las entidades nosológicas mortales que se pueden presentar durante una lipoescultura y además todas presentan manifestaciones clínicas similares. Su severidad depende de la forma de responder de cada paciente, y suelen ser difíciles de diagnosticar y tratar. Con los datos obtenidos y el reporte del estudio forense no se puede determinar en forma categórica cuál causa provocó la muerte, por ello, creemos que hacen falta estudios encaminados a buscar estas patologías para establecer un verdadero diagnóstico.

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I declare that I have no conflict of interest.

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INTRODUCTION

More than 30% of the causes of death related to liposuction had been considered the «cause of unknown death». Recent studies have mentioned that some alterations, such as lidocaine poisoning, vagal reflex and toxic

heart disease due to drug use, may be the cause of these deaths. In the last four years we have detected six cases of death, with difficulty in establishing the cause, all of them with similar pre-mortem clinical factors and manifestations. We present the medical opinion of a prototype case and two topic infographics.

1. Clinical summary. Data obtained from the clinical file, clinic history

A 43 year-old woman, married with the following important background: 2 caesarean sections and 1 liposuction. She denied having used cocaine three months prior to surgery, and smoked up to 10 cigarettes per day. One month before surgery, she did not smoke at all. She was allergic to penicillin and denied having digestive, cardiorespiratory or infectious problems. No other important medical data was recorded. Exploration findings: weight of 65 kg, height of 1.65 m; blood pressure 110/80 mmHg; heart rate of 84 per minute; respiratory rate of 20 per minute. Scars from previous surgery: thoracoabdominal anterior, lateral and posterior lipodystrophy; also asymmetry in the region mentioned; gluteal hypotrophy, with lateral depressions.

Laboratory exams: Held on March 25, 2018. Results: total leukocytes: 7.26; erythrocytes 4.17; hemoglobin 13.5 g/dL; hematocrit 41.2; platelets 270 thousand; lymphocytes 38 monocytes 8.5. Prothrombin time 12; INR 1.03; thromboplastin time 32 seconds. Glucose 91 mg/dL; urea 28.1 mg/dL; BUN serum: 13 mg/dL; uric acid 2.9 mg/dL; creatinine 0.58 mg/dL; total bilirubin: 0.2 mg/dL; direct bilirubin: 0.12 mg/dL; indirect bilirubin: 0.08 mg/dL; alkaline phosphatase 73 U/dL; serum AST: 19 U/dL; serum ALT: 25 U/dL; total proteins: 7.1 g/dL; albumin 4.4 g/dL; globulin 2.7 g/dL. It does not have C-reactive protein, Sedimentation rate.

Electrocardiogram and cardiological assessment were not performed.

A Doping test was not performed.

Entry note and directions: April 3, 2018

Surgeon: it explains everything related to the surgical procedure, as well as the inherent risks such as: asymmetries, skin necrosis, bleeding, infections, anaphylactic reactions, shock, cardiorespiratory arrest, fatty embolism and death.

Preanesthesia Note: a 43-year-old woman with the diagnosis of lipodystrophy. Scheduled for liposuction and fat infiltration in the buttocks; history of 2 cesarean sections and positive drug addiction. She says she has not consumed cocaine for three months. She enters the operating room at 12:30. The anesthetic plan: Double Peridural Block.

Letters of informed consent:

- Medical and surgical treatment; The procedures were explained and consent was requested to perform: liposuction and gluteal lipoinjection. The risks of the surgery were explained: anaphylactic reaction, infection, bleeding, thromboembolism, arrhythmia, shock, cardio-respiratory arrest and death. (Signed by the patient, two witnesses and the doctor in charge).
- Anesthesia. Consent was requested to apply regional anesthesia with peridural block. (Signed by the patient, two witnesses and the doctor in charge).

Surgical procedure: April 3, 2018.

Anesthesia:

1. 1.30 p.m. Double epidural block: cephalic T8 and lumbar L2-L3, 100 mg of lidocaine with epinephrine was applied.
2. 1.50 p.m. 50 µg of desmetomidine (precedex) in 50 mL of water was added, for 80 minutes.
3. 4.20 p.m. Bupivacaine 35 mg was applied, no specific lidocaine dose and 50 mg desmetomidine in 5 mL of water to pass in 20 minutes; the route of application of the medications was not specified. At that time the patient had a blood pressure of 85/55 saturation of 98% and heart rate of 58 beats per minute.

Tumescent solution (solution used to reduce bleeding during aspiration) A physiological solution (0.9% sodium chloride) + adrenaline vial was used; 2,000 mL infiltrated the anterior and lateral thoracoabdominal region and an undetermined amount on the posterior surface.

Surgeries: liposuction of the abdomen, thoracic limbs (arms) and back, performed with 2.5 and 3 mm diameter cannulas. Total suction was of 2,100 mL; lipoinjection of 300 mL of aspirated fat, and amikacin (antibiotic) in each buttock.

Anesthesia time: 3.30 hours.

Surgery time: 3 hours.

Amount of intravenous fluids supplied: 3,000 mL (0.9% saline, mixed, 0.9% saline).

Evolution and transoperative management: (notes of the anesthesiologist, note of the surgeon)

and notes of the nursing staff). In the first stage, 2,000 mL of tumescent solution was infiltrated and abdominal and side liposuction was performed. In the second stage, the patient was turned around in a ventral position (face down) and her arms and back was sucked. In the third stage, the fat was prepared by applying amikacin and 300 mL was infiltrated into each gluteus; which coincides with the third dose of anesthetic. After fatty infiltration, the patient had: dyspnea, hypotension, bradycardia and a significant decrease in oxygen saturation; so it was necessary to turn her over. Once in dorsal recumbency (mouth up), the patient presented cardiorespiratory

arrest; Advanced resuscitation maneuvers characterized by orotracheal intubation with assisted ventilation were performed; application of atropine, adrenaline and calcium gluconate; external cardiac massage. The patient did not respond to resuscitation maneuvers and was pronounced dead at 6:56 p.m.

2. Description of the medical act performed in relation to each clinical event

Documented in notes of anesthesiologists, anesthesia control sheet, post-surgical note of the surgeon and nursing staff notes:

Medical act	Clinical event
<p>Started the procedure (1.30 p.m.) 1. Peridural block was used, lidocaine with epinephrine 100 mg + dexmedetomidine 50 micrograms Surveillance by the anesthesiologist: Hartman solution 1,000 mL, intravenous Oxygen by nasal catheter Monitoring 2. Application of tumescent solution, by the surgeon: 0.9% sodium chloride solution + adrenaline vial per 1,000 mL 1:45 p.m. Start the surgery 1:50 p.m. Dogal epidural dose (?) Early stage of the surgical procedure (1.50 p.m. - 4:15 p.m.) Procedures performed by the surgeon: 1,200 mL abdominal liposuction</p>	<p>Conscious and stable patient; with the following vital signs: Blood pressure 140/60 mmHg; heart rate of 62 per minute; respiratory rate of 12 per minute; 100% oxygen saturation Started surgery</p>
<p>Mediated stage of the surgical procedure (4.20 p.m. - 5:45 p.m.) Anesthesiologist: 4.20 p.m. Application of lidocaine, bupivacaine and dexmedetomidine (the amount applied in each catheter was not clear) Surgeon. Placed the patient in a ventral position, performed liposuction of the back and arms; an amount of 900 mL for a total aspirated of 2,100 mL. Infiltrated 300 mL of fat in each buttock. The time the fat infiltrated was not recorded Late stage (5.50 p.m. - 6.55 p.m.) Surgeon: the surgery was over Anesthesiologist: Started resuscitation maneuvers The following medications were applied: atropine, ephedrine, adrenaline, calcium gluconate Oro-tracheal intubation and assisted ventilation Heart massage Final stage (6.56 p.m.) Anesthesiologist: he finished the resuscitation procedure after 45 minutes and declared the death of the patient</p>	<p>Conscious and stable patient; with the following vital signs: Blood pressure 110 to 140/60-70 mmHg Heart rate from 60 to 70 beats per minute 100% oxygen saturation After application of the anesthesiologist's medications, blood pressure drops to 85/58 mmHg; heart rate at 58 beats per minute and oxygen saturation at 78. Although her vital signs were improved, there was a marked tendency to decrease blood pressure and at the end of this period, bradycardia (decrease in heart rate) was added The following records of vital signs were: Blood pressure 77-104/40-59 mmHg Heart rate 49-59 per minute. Oxygen saturation 78-99% The patient remained in the ventral position and presented bradycardia (low heart rate), hypotension (low blood pressure), respiratory distress and oxygen desaturation The patient is placed in dorsal recumbent, the patient had cardiorespiratory arrest. They started resuscitation maneuvers</p>

3. Result obtained in each act performed

Each medical act performed on a patient has a primary or therapeutic outcome and can have a secondary or adverse outcome. In a therapeutic proportionality, the greatest benefits for patients are sought, with a primary effectiveness of medical activity and a minimal possibility of

a secondary, adverse response for the patient. This applies to most medical acts and to most patients; however, in some patients, due to their idiosyncrasy, the adverse response exceeds the therapeutic. The following table will mention the primary effects and the expected side effects of each medical act performed on the patient.

Act performed	Obtained result
Sedation and regional anesthesia (double block) by the anesthesiologist. Use of the following medications: desmetomidine; lidocaine and bupivacaine	<p>Primary result: Sedation and anesthesia for the patient In order that the surgeon can infiltrate the tumescent solution painlessly and can perform the surgical procedure</p> <p>Secondary result: The medications used could contribute to bradycardia, low blood pressure, oxygen desaturation and cardiorespiratory arrest</p>
Application of tumescent solution by the surgeon. Tumescent solution, also known as Klein solution or solution to infiltrate. Composed of 0.9% saline, lidocaine, epinephrine and bicarbonate. In this case they only used saline and adrenaline	<p>Primary result: Decreased bleeding during fat aspiration</p> <p>Secondary result: The effects of adrenaline are increased heart rate and blood pressure. The patient had elevated blood pressure in the first stage, condition to be expected and had no repercussions</p>
Liposuction and gluteal lipoinjection	<p>Primary result: Body contour improvement Improvement in metabolism Reduction of load to the support apparatus, mainly to the spine</p> <p>Secondary result: Some fatty blood cells, released during the procedure, can pass into the bloodstream; the quantity and size of these globules and the intrinsic response of the patient. These are the factors that determine the repercussions In most cases the repercussions are minimal and can go unnoticed In some cases, fatty embolism syndrome may occur, the pathophysiological basis is inflammation. It is characterized by peripheral vasodilation, petechiae, tachycardia, and temperature rise and usually occurs after 24 hours of the procedure. Most patients survive with a good treatment The most severe response is when the fat passes in larger fragments and in a large amount; fat emboli can obliterate the blood vessels of the lung and heart, causing a massive fulminating fat embolism</p>

4. Pathology report

Presence of vacuoles compatible with fat globules in lungs, heart and liver was reported. They do not describe the presence of a thrombus that obliterates pulmonary or cardiac vessels. No special stains to confirm that the vacuoles were fat were present. In vacuoles the differences between a globule of fat or oil are not marked. There is no pulmonary or cardiac infarction data. There are no toxicological studies. With the data provided, they determined that the cause of death was a massive fulminating fatty embolism.

5. Detailed explanation of what, according to experience and scientific literature, establishes the appropriate management for the health problem; reason for the opinion requested, including the corresponding bibliographical references

a. Act performed: local anesthesia and sedation to perform a liposculpture (liposuction and lipoinjection)

Bibliographic evidence

Liposuction is one of the surgical procedures, most frequently performed in the world. It is used for fat extraction, in order to improve body contour and to improve the patient's metabolism. A solution called «Klein solution» «tumescent» or «solution to infiltrate» is used for its administration. The tumescent solution is composed of lidocaine as a local anesthetic; epinephrine (adrenaline) to produce vasoconstriction and sodium bicarbonate to facilitate the diffusion of the other components. With the subcutaneous infiltrate of this solution, a local anesthetic effect, minimal bleeding and residual analgesia were achieved for several hours.¹⁻³ Some recent authors, in order to increase local anesthesia and increase the amount aspirated, have increased the dose of lidocaine to 55 mg/kg weight; indicating that at these concentrations, its use is safe and the plasma levels reached are below toxic levels.¹⁻¹³ Liposuction procedures can be performed using only the tumescent solution or accompanied by sedation and analgesia to

reduce patient's discomfort. There are several reports, which indicate that lipoaspiration procedures performed with tumescent solution and regional blockages and sedation. They are safe and have a low incidence of complications. The participation of anesthesiologists is essential, since many patients prefer to be sedated during the procedure. In case complementary analgesia is needed or a patient undergoes more than one procedure at the same surgical time, the presence of the anesthesiologist guarantees the control of the airway, monitors the patient, maintains his/her stability and controls the pain.^{11,14-21}

Opinion: regional anesthesia (double block) plus sedation and application of a tumescent solution used in the patient in this case, to perform liposuction and gluteal lipoinjection may be useful. The risk is anesthetic overdose, which can be potentiated with other medications such as desmetomidine. This can cause hypotension, bradycardia and asystole resistance to the standard treatment. When working with general anesthesia or regional block, the application of lidocaine in the tumescent solution is not required. By not using it, the risks are reduced. In the present case, they did not use lidocaine in the tumescent solution. Although lidocaine, bupivacaine and desmetomidine were used in a poorly quantified dose.

b. Act performed: liposuction and lipoinjection procedures were performed in a hospital that meets international safety goals, dictated by WHO

Bibliographic evidence

There are several publications that give information that the procedures performed in clinics and hospitals that have safety resources and apply the international safety goals for the surgical patient. The rate of complications and mortality is very low.²²⁻²⁶

Opinion: the patient was operated in a hospital. In the file, there is evidence of a checklist, which is a tool that is used to verify that the safety goals are being applied. The hospital where the patient was operated on has safety resources, such as monitors, anesthesia

devices, suction devices, oxygen, and restricted areas only for surgical staff, qualified personnel and safety regulations. The surgeon decided to operate the patient in a hospital, seeking patient's safety.

c. Act performed: liposuction and lipoinjection; death risk

Bibliographic evidence

Liposuction is a safe procedure in most patients; however, complications can occur and some of them can be fatal. The ASAPS (American Association of Plastic Surgeons) reported 20 deaths per year, per 100,000 lipoaspiration; in Mexico in 2014 we found 17 deaths related to liposuction.^{11,27-29}

Opinion: liposuction and lipoinjection procedures are safe. Mortality, for US surgeons, is fewer than 20 deaths per 100,000 lipoaspiration and, for Mexico, 14 per 100,000. Patients, who are operated, accept the risk and sign an informed consent letter (*Infographics*). In this case, the patient and her witnesses signed an informed consent letter, accepting the risks.

d. Act performed: Liposuction and lipoinjection; risk of fatty embolism

Bibliographic evidence

In liposculpture (liposuction and lipoinjection), the fatty accumulation is aspirated and the material obtained is processed to infiltrate and increase the volume, mainly of the buttocks. Most surgeons infiltrate fat into the gluteus muscle, in order to favor its integration. The procedure is safe in most patients.³⁰⁻³⁵

This procedure causes trauma to small blood vessels, increased interstitial pressure secondary to infiltration of the solution and fat injection, conditions for small fatty globules to pass into the bloodstream, in the majority of patients with minimal repercussions that do not endanger their lives. In research studies conducted in pigs and women volunteers who were given a lipoaspiration and lipoinjection, the presence of small fat globules in the alveolar and renal capillaries was evident; local and systemic inflammatory response and pulmonary

alterations attributable to the presence of these globules, the manifestations they presented did not cause major damage or death.^{36,37}

There is a limited number of patients who are very sensitive to the action of fatty blood cells in their blood circulation. The fatty globules can cause severe inflammatory or embolic alterations (clogging of blood vessels) in these patients. In the first alteration, also known as fatty embolism syndrome, its pathophysiological basis is a severe inflammatory response. The fat trapped in the capillaries is metabolized by the action of lipases (enzymes) with the release of fatty acids, which are responsible for the local and systemic inflammatory response. The syndrome usually occurs 24 to 72 hours after the procedure. The diagnosis is made using the criteria of Gurd and Wilson, considering that the major criteria are: respiratory failure, petechiae and cerebral deterioration; and the minor are: fever, tachycardia, retinal alterations, renal alterations, anemia, thrombocytopenia (decrease in number of platelets), elevated globular sedimentation, macro fat globulinemia, fatty sputum and lipuria (urine with fat). The second alteration or denominated fulminating fat embolism is more rare. Fatty blood cells can cause a blockage of vital blood vessels. There are some reports that mention that during lipoaspiration and lipoinjection, cardiac, pulmonary or cerebral blockages can occur due to fatty globules. Death occurs suddenly, sometimes without previous clinical manifestations. The fat embolism related to lipoaspiration has not been diagnosed categorically due to the difficulty to identify fatty cells and differentiate them from free fatty acids and correlate them with the embolic or inflammatory effect in clinical and post-mortem studies.^{11,21,27,28,38-42}

Opinion: In this case, the patient underwent lipoaspiration and lipoinjection in the buttocks. These procedures drive fatty blood cells into the bloodstream. This circulating fat, in most patients, does not cause any harm. In a small group of patients; due to factors not yet known, the fat cells or the oil released can produce a syndrome of fatty embolism or a fulminating fatty embolism. The patient had no signs of a fatty embolism syndrome. This is a systemic inflammatory process. There were no major or

minor manifestations of the diagnostic criteria of Gurd and Wilson.

The fulminant fat embolism can occur progressively. Small plugs are obliterating vital blood vessels until the total blockage occurs and, with it, the patient's death. In these cases there are neurological alterations, dyspnea, oxygen desaturation, increase or decrease of blood pressure and tachycardia. In cases of large fat plugs, immediate obliteration of a vital blood vessel occurs; death occurs suddenly, without previous manifestations.

The patient this case had: hypotension, oxygen desaturation and bradycardia (decreased heart rate) in the last 90 minutes (after the last application of anesthetics) (*Infographics*).

e. Act performed: Liposuction and liposculpture (liposuction and lipoinjection). Tumescence solution; risk of poisoning by lidocaine

Bibliographic evidence

Lidocaine is an anesthetic that is used in local procedures, in regional blockades. It has also been used to control cardiac arrhythmias; in lipoaspiration, it is used as a local anesthetic in the tumescent solution. Bupivacaine is another anesthetic with similar actions.⁵⁻¹⁰ These anesthetics can cause: hypotension and bradycardia and suppress cardiac automatism. Adverse effects are due to sensitivity to the drug, higher doses; deficiency in enzymes (cytochrome CYP3A4) that inactivates in the body, medications that compete for enzymes, and liver or kidney failure. There are very sensitive patients who can overreact to a very low dose, causing fatal complications. The plasma concentrations found in these medications in post-mortem studies do not reflect their toxic effects. Blood stability after death is not known and does not reflect substantial real concentrations in the nervous or cardiovascular tissue or those found at the time of the crisis. Many cases of deaths, due to an unknown cause, may be related to the toxic effects of lidocaine, other anesthetics, such as: bupivacaine, combined or not, with medicines that compete with cytochrome, such as: desmetomidine or propofol. Poisoning by these anesthetics is difficult to solve.

Recommendations for treatment have little basis and are used as a salvage measure.^{1-13,43-53}

Opinion: In the present case, the application of lidocaine in the tumescent solution was avoided in order to prevent adverse effects. However, it was used in three doses and applied in the two catheters that were used in the peridural block and combined with bupivacaine and desmetomidine. The exact dose cannot be specified because of the illegibility of the notes. Only a small number of patients, less than 0.002% in whom lidocaine is applied as an anesthetic, suffer intoxication with severe alterations, which can cause death. The diagnosis of lidocaine poisoning is very complex. Lidocaine is very labile and changes rapidly its plasma concentrations. There are few laboratories that can determine their plasma levels and these do not represent the figures reached at the time of the event. In addition, there are several pathological entities that occur with similar manifestations, such as: fatty embolism syndrome, poisoning or adverse response to other medications and heart failures. The signs presented by the patient, prior to her death, may have been due to an adverse response to lidocaine; however, she could not fully handle the difficulties mentioned above. The patient had a history of cocaine addiction. If she also drank alcohol and used any other drug is not stated. No study of anti-doping, liver function tests or determination of inflammatory processes was performed. If the patient had liver problems or cytochrome CYP3A4 deficiency, the adverse effect of anesthetics could be attributed to these factors (*Infographics*).

f. Act performed: liposuction and liposculpture (liposuction and lipoinjection). Double lock, high lock. Cocaine addiction. Risk of death of unknown cause

Bibliographic evidence

Previous reports mention that in 29 to 31% of deaths related to liposuction, the cause cannot be established.^{27,54}

In *post-mortem* studies, rarely, in patients who had undergone liposuction are the following common factors found. Patients

suddenly had: hypotension, bradycardia and desaturation. The cause of death could not be identified. In all, tumescent solutions with lidocaine were applied; midazolam was used. They were all obese and had no history of anaphylaxis, heart disease, or had they used illicit substances (drugs). Rao relates the tumescent solution with mortality due to the toxic effects of lidocaine and the interaction with other medications, such as: midazolam or other anesthetics or analgesics.³

A cardiovascular depression, due to a vagal reflex (Bezold-Jarisch syncope) produces a significant decrease in venous return to the heart, vasodilation, bradycardia and cardiac arrest. This reflex can occur due to the effects of regional anesthesia, hemorrhage, compression of the vena cava by the gravid uterus or owing to the combination of factors.⁵⁵

Cocaine produces chronic effects in different structures. Cardiac alterations are characterized by toxic cardiomyopathies, ischemic heart disease and myocardial infarction. Cocaine is metabolized by cytochrome p450 CYP3A4. It is the same cytochrome that the body uses to metabolize lidocaine and other anesthetics. In patients with suspected or confirmed consumption, routine tests should be performed, especially important, for liver function tests. In addition, an electrocardiogram and evaluation by a cardiologist should be requested to rule out the cardiac pathologies attributed to cocaine and anti-doping. It is common for the addicted patient to use the drug days or hours before surgery to mitigate their anxiety and correct withdrawal.^{51-53,56}

Opinion: sudden deaths during liposuction were initially associated with fulminant massive fatty embolism. However, in more than 30% of cases, the cause of death could not be determined by calling them «unknown cause». Rao was the first to recognize that in this group. Cases of lidocaine poisoning should be included. Other causes that we must keep in mind are: the vagal effects of high epidural blockages and heart disease caused by drug use. Forensic studies should keep these changes in mind and intentionally look for these changes. The patient was exposed to these factors: cocaine use with the possibility of cardiomyopathy that could cause crisis during

surgery; application of several anesthetics in epidural blocks and systemically, the exact dose, could not be determined. It is to be expected for a patient addicted to cocaine to have a deficiency of cytochrome p450, which makes anesthetics have a greater toxic effect. Another factor was the use of a high block that could cause a vagal reflex. The post-mortem studies they performed did not rule out these possibilities.

g. Act performed: Liposuction and liposculpture (liposuction and lipoinjection). Forensic study, fat embolism

Bibliographic evidence

Studies in voluntary patients and in laboratory animals who underwent liposuction and fat transfer, have found fat in the blood and urine. The repercussions on the heart and lungs are minimal and do not endanger life.^{36,37,41,42} The identification of fat in blood and urine requires special stains such as «red oil» and Sudan III.⁴²

Opinion: the forensic pathology study identified vacuoles suggestive of fat, but could not verify its content, since they did not perform special stains; nor could they verify whether oil or fat globules formed these vacuoles. Thus, they could not determine whether the vacuoles caused a blockage of important blood vessels in the heart or lungs to cause a heart attack. No other studies were conducted to rule out the other causes of death that appear with similar clinical characteristics. The pathology study was incomplete and was not useful in determining the cause of death.

6. Personal conclusion, to establish if the handling was adequate

With the data obtained, a diagnosis of certainty of the cause of death cannot be established. There are several nosological entities that can occur during liposuction and infiltration of fat in the buttocks and are present with the same symptoms: oxygen desaturation, bradycardia, hypotension and asystole. These nosological entities are: fulminant massive fatty embolism, heart failure, due to toxic heart disease (cocaine), lidocaine poisoning and vagal effect,

due to epidural blockages. The patient in this case had factors of these pathologies. The aforementioned manifestations began to occur before the infiltration of fat in the buttocks. The fatal crisis coincided with the application of fat and the application of the following doses of anesthetics. All these entities have similar clinical signs. They have a low incidence; their presentation depends on the patient's response, and they are difficult to diagnose and treat. With the data obtained and the report of the forensic study, the cause of death cannot be determined categorically. Studies are needed to look for these pathologies to establish the true diagnosis.

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SECURITY RECOMMENDATIONS



Fatal complications in lipoaspiration

There is a **worldwide increase** in number of liposuction procedures. In some countries, it has increased **up to 200%**. In Mexico, **62,713 liposuctions were performed** in 2013.

- Gracer FM, Jong RH. Fatal outcomes from liposuction. Census survey of cosmetic surgeons. Reconst Surg 2000; 105: 436-446.
- www.isaps.org/news/isaps.global.statistics

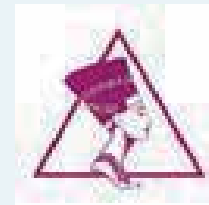
200% Increases of liposuctions worldwide



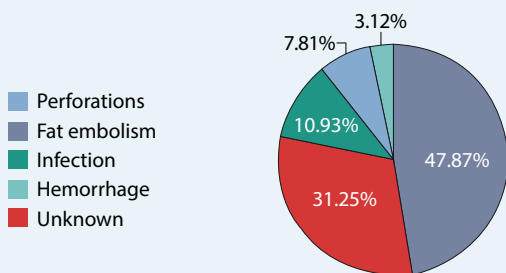
* ASAPS report

Mortality causes are the following:

- | | |
|-------------------|------|
| • Thromboembolism | 23% |
| • Perforations | 15% |
| • Fat embolism | 8.5% |
| • Heart failure | 5% |
| • Infection | 5% |
| • Hemorrhage | 5% |
| • Unknown | 29% |



Mortality causes in Mexico are the following:



Many researchers have found that lidocaine poisoning is one of the main causes of death in patients with unknown cause.



- 68.73% Dyspnea, cough, hypotension, bradycardia and desaturation
- 26.46% Apnea, arrhythmia, tachycardia, seizures, headache, precordial pain and vasodilatation
- 7.81% Other manifestations



Applying the **international safety goals** and the **specific recommendations of the specialty** will **decrease** occurrence of fatal complications in **liposuction procedures**.

SECURITY RECOMMENDATIONS

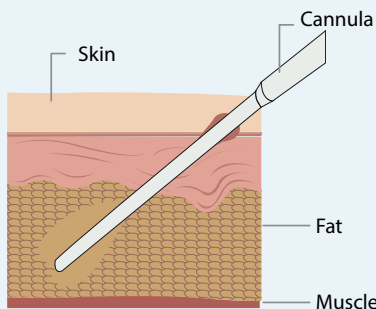


Death in liposuction

In Mexico, more than **62,700 liposuctions** are performed every year. More than **90%** of surgeons report a **combination of liposuction with gluteal lipoinjection**.

Fat embolism

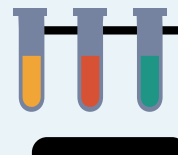
During gluteal lipoinjection, there is fat entering the bloodstream. Entry is greater if fat is injected into the muscle tissue than into the subcutaneous cellular tissue.



62,700 liposuctions procedures every year

A **1/3** of patients who die from liposuction also have a gluteal lipoinjection performed.

There are studies that confirm the presence of body fat during and after a gluteal liposuction/lipoinjection



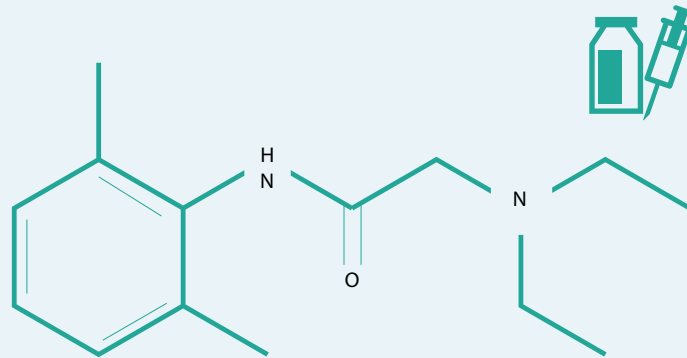
- Urine: lipuria
- Blood: globules of fat, fat macroglobulinemia (igm)
- Staining procedure for fats: red oil and sudan III

Fat entering the bloodstream can produce two serious pathologies:

- Fat embolism syndrome - inflammation (microscopic fat)
- Macroscopic fat embolism - blockage (macroscopic fat)

	Fat embolism syndrome	Macroscopic fat embolism
Physiopathology	Secondary to biochemical processes Fat microembolism in circulation, producing an increase in free fatty acids and biochemical alterations, causing a systemic inflammatory response and tissue damage	Secondary to mechanical processes Fatty tissue in large vessels due to entry of secondary fat in vascular injury caused by lipoinjection, producing obstruction of heart chambers and pulmonary artery
Start of clinical picture	<ul style="list-style-type: none"> • Fulminant: first 24 hours • Classic: between 24 and 72 hours • Delayed: after 72 hours 	Always fulminant <ul style="list-style-type: none"> • Intraoperative during lipoinjection or when changing patient's position
Manifestations	Petechia, disorientation and CNS depression, tachycardia, polypnea, vasodilatation, fat in sputum	Bradycardia, dyspnea, sever hypoxia, hypotension
Prognosis	<ul style="list-style-type: none"> • Mortality from 10 to 50% • With an early identification and support measures, mortality decreases considerably 	<ul style="list-style-type: none"> • Almost always fatal • Extremely difficult to reverse
Prevention	The main prophylactic measure is to Keep patient Hydrated appropriately, in order to avoid free fatty acid concentration in bloodstream For that purpose, the patient must remain hospitalized at least 24 hours for intravenous hydration	Avoid Injuring Gluteal Vessels during lipoinjection: <ul style="list-style-type: none"> • Mainly inject subcutaneous cellular tissue • Do not inject fat into muscle • Keep cannula parallel to the gluteal contour • Be particularly careful to inject from the subgluteal sulcus • Use blunt cannulas • Softly inject without excessive pressure

Case of death by liposculpture



Adverse effects of lidocaine

Rao reported several patients subjected to liposuction showed sudden hypotension, bradycardia and desaturation, and the cause of death could not be identified.

Recent authors consider that adverse effects of lidocaine are the responsible for the deaths diagnosed as unknown and misdiagnosed cases of fat embolism.

Lidocaine can cause hypotension, bradycardia and suppress heart automaticity. Neurotoxic manifestations precede vascular collapse. Post mortem studies regarding toxicity of lidocaine are not reliable.

Lidocaine is metabolized in the liver by the isoenzyme CYP3A4, part of the cytochrome P450 family. When this cytochrome is saturated, a sudden rise in lidocaine is produced.



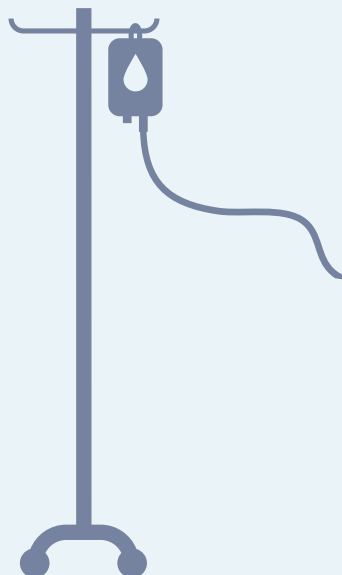
Toxic dose of xylocaine is 7 mg/kg (SDA).



In the tumescent solution, a mega-dose of 35 and 50 mg/kg is used.

Causes of toxic effects by lidocaine

- Cytochrome deficit
- Sensitivity to the medication
- Liver or kidney damage
- Overdose
- Reabsorption



An increase of mortality of 0.7% per extra milligram of lidocaine used is reported.

20% lipid emulsion has been used to treat the cardiotoxic effects of bupivacaine; therefore, it has been proposed that the toxic effects of lidocaine can be treated with advanced cardiac life support protocols and 20% lipid emulsion in a 1.5 mL/kg bolus, repeating quantity within 3-5 minutes. After restoration of sinus rhythm, keep a 20% lipid infusion, 0.25 mg/kg weight per minute.