

Deaths Caused by Gluteal Lipoinjection: What Are We Doing Wrong?

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Background: Intramuscular gluteal lipoinjection has become one of the most commonly used surgical procedures for achieving improvement in the gluteal contour; however, there are few studies that report and analyze the causes of secondary death from this surgical procedure.

Methods: An analysis of secondary deaths from gluteal lipoinjection procedures was performed in Mexico and Colombia over periods of 10 and 15 years, respectively. In Mexico, the study was performed through a survey of all members of the Mexican Association of Reconstructive, Plastic and Aesthetic Surgery. In Colombia, the study was performed through an analysis of deaths and autopsies documented by the National Institute of Legal Medicine and Forensic Sciences Regional Bogotá.

Results: A total of 413 Mexican plastic surgeons reported 64 deaths related to liposuction, with 13 deaths caused by gluteal lipoinjection. In Colombia, nine deaths were documented. Of the 13 deaths in Mexico, eight (61.6 percent) occurred during lipoinjection, whereas the remaining five (38.4 percent) occurred within the first 24 hours. In Colombia, six deaths (77.7 percent) occurred during surgery and three occurred (22.2 percent) immediately after surgery. In the Colombian autopsy results, seven cases of macroscopic fat embolism and two cases with a microscopic embolism were reported, with abundant fatty tissue in the infiltrated gluteal muscles.

Conclusions: In this study, the authors found that intramuscular gluteal lipoinjection is associated with mortality caused by gluteal blood vessel damage allowing macroscopic and microscopic fat embolism; therefore, buttocks lipoinjection should be performed very carefully, avoiding injections into deep muscle planes. (*Plast. Reconstr. Surg.* 136: 00, 2015.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, V.

With the introduction of liposuction in 1976 by Fischer¹ and subsequent refinements in the technique by Illouz,² the procedures of body contouring in aesthetic surgery underwent a complete change. The procedures, with large cuts and deforming scars,^{3,4} were transformed into highly gratifying operations with minimal signs of surgery.

Although liposuction developed into a procedure that achieved very satisfactory results, it also gave rise to techniques that had been forgotten, including autologous fat transfer, which has become another surgical method that is indispensable for any plastic surgeon. The acceptance and use of this operation has increased in recent years, with hip augmentation by lipoinjection currently peaking as a treatment.⁵⁻⁸ Lipoinjection has been used in the buttocks to increase volume, and injection into the muscle is being performed to aid in integration. Although most authors believe that the procedure is safe, others report many complications, some of which are severe and even fatal. Complications can be only local (e.g., abscess development) or general (e.g., pulmonary

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thromboembolism and fat embolism).^{9,10} Therefore, we analyzed deaths associated with this surgical procedure in two of the countries where more gluteal lipoinjection is performed, namely, Mexico and Colombia.

PATIENTS AND METHODS

A retrospective study was performed analyzing cases in which death was associated with liposuction combined with gluteal lipoinjection. The study was carried out simultaneously in Mexico and Colombia, countries where this procedure is widely performed. The methodology for capturing data in each country was different, because of the feasibility of obtaining data in each of them. In Mexico, an online survey was sent to all members of the Mexican Association of Reconstructive, Plastic and Aesthetic Surgery (AMCPER by its initials in Spanish), the official organ of Mexican plastic surgeons. This survey requested information about the surgical procedures associated with liposuction and lipoinjection and deaths over the past 10 years associated with these operations that occurred during the first 24 hours of initiating surgery. In Colombia, the cases were analyzed by reviewing the records of patients who had died in that country during a 15-year period and who had been diagnosed by autopsy at the National Institute of Legal Medicine and Forensic Sciences Regional Bogotá (Instituto Nacional de Medicina Legal y Ciencias Forenses Regional de Bogotá) with fat embolism as the cause of death. The data were analyzed by descriptive statistics by determining the frequency and proportions.

RESULTS

Thirteen-hundred e-mails were sent to Mexican plastic surgeons that were members of the Mexican Association of Reconstructive, Plastic and Aesthetic Surgery. We received replies from 413 plastic surgeons, of whom 378 (91.6 percent) reported performing lipoinjection together with liposuction, and 35 (8.4 percent) who did not usually perform lipoinjection jointly with liposuction. From 2005 to September of 2014, 64 deaths were reported. Fourteen cases (21.87 percent) occurred in patients who underwent liposuction and gluteal lipoinjection. Autopsy verified that the cause was fat embolism in 13 cases and myocardial infarction in one case. In nine of the 64 deaths (14.06 percent), death occurred at the time of performing the lipoinjection, and in the other five (7.8 percent), death occurred after finishing surgery but within the first 24 hours of initiating surgery. In eight of

the 13 deaths caused by lipoinjection (61.5 percent), death occurred during surgery, and in the remaining five (38.5 percent) it occurred between 1 and 24 hours after lipoinjection. In the analyzed records of the patients who died in Colombia between 1993 to 2008 that had been diagnosed by autopsy by the National Institute of Legal Medicine and Forensic Sciences Regional Bogotá, 28 deaths were found to be related to liposuction. In nine of these cases, there was a combination of liposuction and lipoinjection. Autopsy revealed that the cause of death was macroscopic fat embolism in seven of the nine cases (77.7 percent) and microscopic fat embolism in the two remaining cases (22.2 percent). There were six deaths during surgery (66.6 percent) and three (33.3 percent) within the first 18 hours in the intensive care unit. All of the patients were women aged between 27 and 53 years, with an average age of 39.5 years, and all of the patients underwent fat infiltration in the buttocks to improve contour. The body mass index ranged from 19.4 to 27.2 kg/m², with an average of 24.1 kg/m². The amount of fat removed varied between 2000 and 7200 cc, with an average of 3697 cc, and the amount infiltrated per buttock varied between 120 and 300 ml, with an average of 214 ml per buttock. All of the patients died within the first 18 hours after surgery had started, six during surgery and three in the intensive care unit within the first 18 hours after initiation of surgery. The results, with the specific characteristics of the nine patients, are listed in Table 1. Autopsy findings are shown in (Figures 1 through 9). One representative case is presented.

CASE REPORT

Case 1

The patient in case 1 was a 37-year-old woman with a weight of 59 kg (130 lb), a height of 1.54 m (5.05 ft), and body mass index of 24.88 kg/m² (Figs. 1 through 4). The patient presented for consultation and requested improvement of abdominal and waist adiposities, buttocks enlargement, and septoplasty. She did not have a significant medical history. Before surgery, antiembolism stockings were placed, and 2500 units of dalteparin sodium was administered subcutaneously. Before liposuction, 4000 ml of a preparation consisting of 1000 ml of isotonic saline solution, 1 mg of adrenaline, and 10 cc of 2% lidocaine was infiltrated. A total of 2600 cc was obtained by liposuction and 120 cc was infiltrated into each buttock. While changing the patient position from dorsal decubitus to ventral decubitus, the patient was found to be hypotensive, with sudden cardiorespiratory arrest that did not respond to resuscitative maneuvers, and she died.

Autopsy Findings

The possibility that mechanical injury secondary to the surgical procedure was discarded.

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Table 1. Results

Patient	Age (yr)	Height		Weight		BMI (kg/m ²)	Moment of Death	Gluteal Liposuction Lipoinjection		Most Significant Data from the Autopsies
		Meters	Feet	Kilograms	Pounds			(cc)	(cc)	
1*	39	1.54	5.05	59	130	24.88	During surgery	2600	120	Presence of thrombi at the level of pulmonary vessels, corresponding to massive fat embolism, in small, medium, and large vessels, associated with pulmonary edema, massive fat embolism
2	27	1.60	5.24	55	121	21.48	During surgery	6000	300	Special coloration for positive intravascular fat in lung with focal infarctions; negative for intravascular fat in the brain; vessels with presence of intravascular fat in the marrow
3†	42	1.54	5.05	55	121	23.19	During surgery	2300	150	Large and medium pulmonary vessels with large fragments of adipose tissue, with septae of fusiform cells typical of the adipose matrix; embolism adipose tissue in small and medium vessels in the brain; fragments of fat in the right cavities of the heart
4	39	1.60	5.24	60	132	23.44	1 day after surgery, in intensive care unit	4500	260	Presence of adipose tissue in small pulmonary and cardiac vessels, in lung in both veins and arteries, abundant fat globules surrounded by fibrin and occasional white cells or mature adipose tissue; in the heart in venous vessel fragments of adipose tissue; suprarenal capsule with abundant lipids and cerebral edema
5	53	1.63	5.34	69	152	25.95	18 hr after surgery, in intensive care unit	3000	180	Presence of fat embolisms in the brain and the lung circulation; in small and medium vessels of the lung, yellowish white embolisms protrude, consistent with fat embolisms; histologically mature adipocytes in the arteries
6‡	51	1.54	5.05	60	132	25.30	10 hr after surgery, in intensive care unit	2000	200	Lung vessels with fat thromboembolism, thrombi of fibrin; acute tubular necrosis; thrombi with fat vacuoles in small brain vessels; pulmonary and brain fat thromboembolism; noncrepitant lung with fat globules in all pulmonary lobes and segments; no blood thrombi found
7	28	1.61	5.28	68	150	26.23	During surgery	4000	250	Drops of fat are seen in pulmonary vessels of lower lobes; abundant adipose tissue inside of the blood vessels
8	52	1.53	5.01	65	143	27.27	During surgery	7200	230	Presence of large fragments of adipose tissue with some fusiform cells typical of the matrix of this tissue, which fills large and medium pulmonary vessels; no fibrin thrombi in vessels; no hemorrhaging or fat globules observed in kidneys; section of upper gluteal vein seen
9§	25	1.47	4.82	42	93	19.4	During surgery	1680	240	Abundant adipose tissue in the vena cava, cardiac ventricles, and pulmonary vessels; upper right gluteal vein perforation; hematomas in subcutaneous and dorsal and abdominal muscle planes, extensive hematoma mediastinal; section of upper gluteal vein seen
Mean ± SD	39.5 ± 11	1.56 ± 0.5	5.11 ± 0.5	59.22 ± 8.2	130.5 ± 8.2	24.12 ± 2.5	6 during surgery 3 after surgery	3697 ± 1900	214.44 ± 57	Fat embolism

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BMI, body mass index.

*Photographs of this patient's autopsy are shown in Figures 1 through 3.

†Photographs of this patient's autopsy are shown in Figure 4.

‡Photographs of this patient's autopsy are shown in Figure 5.

§Photographs of this patient's autopsy are shown in Figures 6 through 9.

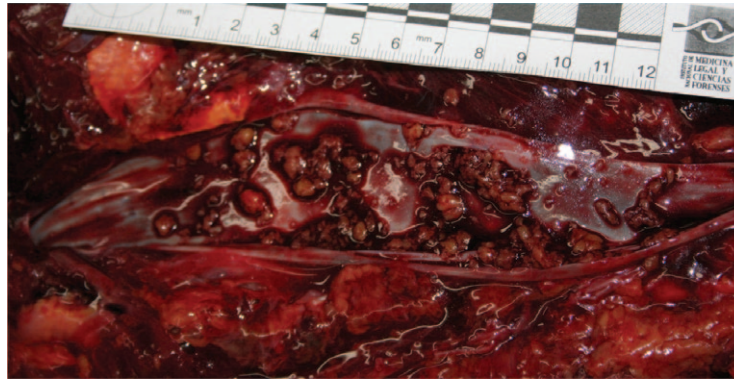


Fig. 1. Case 1. Presence of macroscopic fat in the vena cava in a patient who died during surgery at the time of lipoinjection. (Printed with permission from Aguirre-Serrano H, Bernal M, Navarro A, Montes G, Morales P, Téllez N. Embolia grasa macroscópica por lipoinyección glútea. ¿Una nueva patología?. *Rev Colomb Cir Plast Reconstr.* 2011;17:43–48.)



Fig. 2. Case 1. Macroscopic adipose tissue in the right atrium in a patient who died during surgery. (Printed with permission from Aguirre-Serrano H, Bernal M, Navarro A, Montes G, Morales P, Téllez N. Embolia grasa macroscópica por lipoinyección glútea. ¿Una nueva patología?. *Rev Colomb Cir Plast Reconstr.* 2011;17:43–48.)

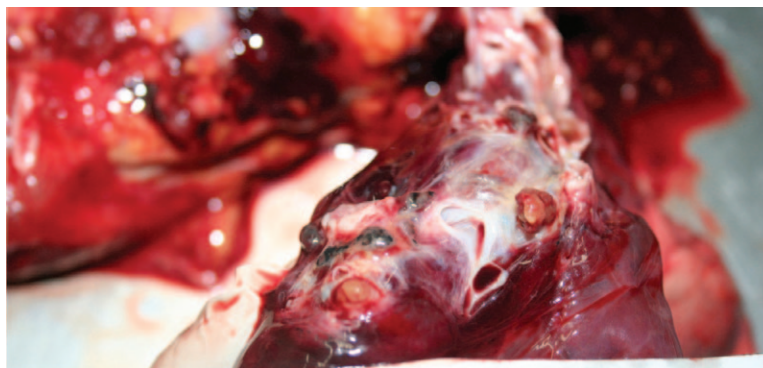


Fig. 3. Case 1. Compression of the lung obtaining adipose tissue from a patient with macroscopic fat embolism. (Printed with permission from Aguirre-Serrano H, Bernal M, Navarro A, Montes G, Morales P, Téllez N. Embolia grasa macroscópica por lipoinyección glútea. ¿Una nueva patología?. *Rev Colomb Cir Plast Reconstr.* 2011;17:43–48.)

AQ7 One hundred cubic centimeters of citrine fluid was found in the pleural cavities without the presence of any fibrous adhesions. The lungs had increased in size and were edematous, with subpleural purplish hemorrhagic areas based on predominantly right lower lobe firm purplish

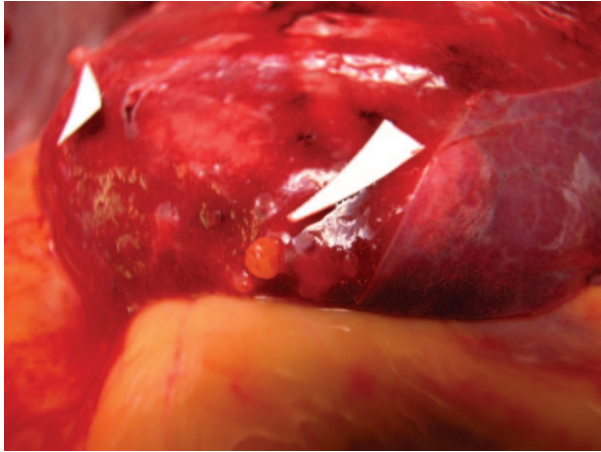


Fig. 4. Case 3. Pulmonary tissue with presence of large fragments of fat globules.

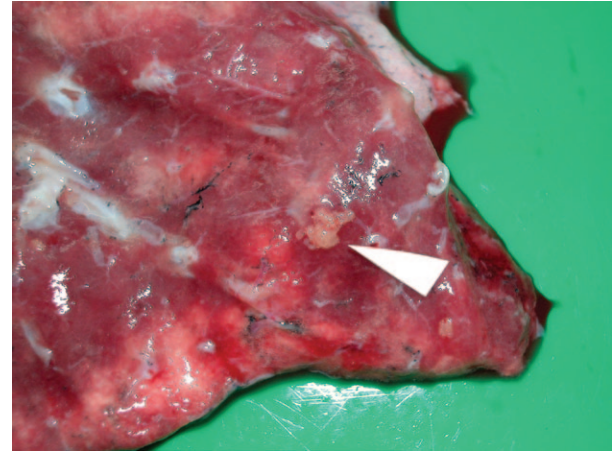


Fig. 5. Case 6. Noncrepitant lung with fat globules in all pulmonary lobes and segments.

clots that were similar in appearance to toothpaste, which is consistent with thrombi. A microscopic study showed that the lungs contained a pink material in the alveoli and histiocytes with pigment inside. Obstructive thrombi were found in large, medium, and small vessels, consisting of fibrin, blood cells, and abundant fat. All cuts showed fat thrombotic damage. There were focal points of autolysis. The kidneys, heart, and spleen showed congestion. The brain weighed 1200 g and was found to have edema and vascular congestion. In the peritoneal cavity, 600 cc of hematic serum fluid was found, with marked congestion of the intestinal areas. The retroperitoneum presented with an adipose appearance with a slight right hematoma that contained approximately 100 cc of blood. No perforation was found.

The principal findings were massive pulmonary fat embolism with pulmonary edema and generalized visceral vascular congestion. The cause of death was a massive pulmonary fat embolism with pulmonary edema (Figs. 1 through 4).

DISCUSSION

Body contouring surgery has evolved since 1976 with the appearance of liposuction.^{1,2} Because of perfecting the techniques, the fat obtained was used in improving results by implementing the transfer of autologous fat by lipoinjection.⁵⁻⁸ According to reports from the International Society of Aesthetic Plastic Surgery, liposuction was the second most common aesthetic surgical procedure worldwide in 2013,¹¹ and although there are no exact data on the frequency of gluteal lipoinjection combined with liposuction, there are multiple reports regarding the combination by multiple doctors.⁴⁻⁸ In

the survey of Mexican plastic surgeons, 92 percent reported that they usually combine gluteal lipoinjection when performing lipoinjection. Because of multiple studies and clinical series with very good results,^{4-8,12-15} lipoinjection has become a procedure widely accepted by the entire medical community worldwide. In the search for better survival, experimental studies in rats have shown that injecting the fat into muscle allowed a high integration of adipose tissue.¹⁶ This procedure provided the adipocytes with greater vascularity, and survival of the adipose cells was much greater than when fat was injected outside of the muscle.

Initially, lipoinjection was used in small volumes and very circumscribed areas to achieve precise localized improvements, especially in the face.¹²⁻²² Because of the excellent results, its use was extended to other areas to achieve improvement of body contouring. Therefore, it was applied to areas such as the buttock, an area where it produces more benefit and which previously had few treatment options.⁵ Gluteal lipoinjection became a treatment with excellent results regarding the volume and shape of these areas.⁵⁻⁸ With longer fat survival through muscular injection, which has been shown by experimental studies¹⁶ and ratified with clinical studies,^{12,14,18} fat injection was performed into the muscular area of the buttock. However, the fact that the application of an experimental study for a clinical purpose is completely different was never taken into account. Cases with fat embolism and the syndrome of fat embolism began to occur. Studies have reported that during fat management during liposuction or lipoinjection, particles of fat can enter the bloodstream and facilitate the appearance of a fat embolism

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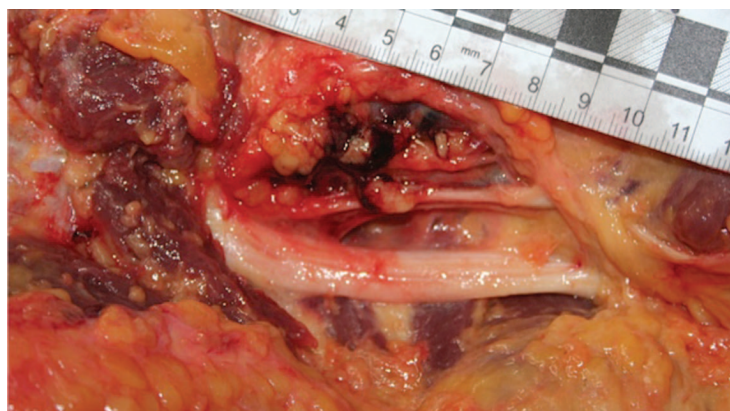


Fig. 6. Case 9. Dissection in suprapyramidal canal, showing globules of complete adipose tissue and section of the superior gluteal vein.

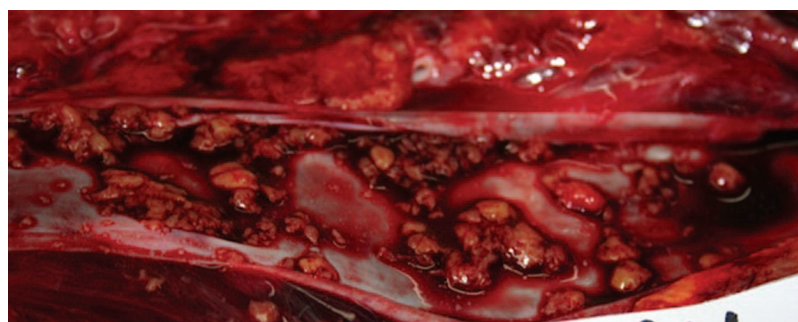


Fig. 7. Case 9. Vena cava with adipose tissue.



Fig. 8. Case 9. Section of gluteus maximus muscle and the presence of lipoinjected tissue, a common finding in the autopsies.

syndrome or a fat embolism.^{23–28} The physiopathology of these two entities is different; therefore, the clinical manifestations are different as well. We feel that the amount and size of the fat particles along with the speed with which the fat particles enter the bloodstream determine the type of clinical manifestations that appear. The fat embolism syndrome is caused by a systemic inflammatory response.^{23,27,28} In contrast, fat embolism is essentially a mechanical problem. In addition, although the fat embolism syndrome is serious, critical

attention can resolve the manifestations without major sequelae. In fat embolism, the problem is immediate and caused by blockage of medium and large vessels, which occurs during lipoinjection. This occurs at the time of the fat infiltration, when signs and symptoms indicate a blockage at the cardiac level or in pulmonary vessels, and the patient usually dies despite immediate attention.²⁷ If during lipoinjection a patient shows sudden cardiovascular changes, such as hypoxia and bradycardia, we must think of this problem. In these cases, we

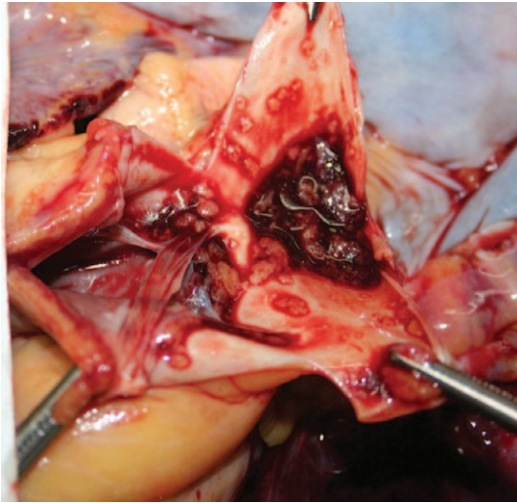


Fig. 9. Case 9. Heart and adipose tissue in the interior of the right atrium.

can speak of a macroscopic fat embolism, which has been rarely reported in the medical literature.

It is undeniable that fat injection in highly vascularized beds involves better survival of the adipose tissue, but it is also true that any injection into highly vascularized tissues involves a higher risk of producing entry of the injected substance into the blood vessels of the area. In addition, in the case of fat, the consequences can be very serious. There are multiple reports of permanent blindness^{29–32} and even damage to other organs from the occlusion of arteries resulting from fat infiltration.^{32–37} Regarding the buttocks, the large venous vessels in the area—specifically, the gluteal vein in the subpyramidal or suprapyramidal channels—and the large muscular vascularity facilitate entrance of fat into the bloodstream. Secondary to its entry into the bloodstream, a fat embolism syndrome or fat embolism may be produced, depending on the factors listed above.

A consensus of Colombian plastic surgeons and Colombian anesthesiologists shows that they considered buttocks lipoinjection to be a risk factor and the cause of fulminant massive thromboembolism.³⁸ In our studies of both series, we found that 12 of the 21 deaths (57.1 percent) occurred at the time of lipoinjection during the surgical procedure, whereas nine (42.8 percent) occurred immediately postoperatively within the first 24 hours after initiation of surgery. Coincidentally, in patients with data from the operation and the autopsy, it was found that the deaths during surgery occurred when the fat embolism was clearly macroscopic, and damage to blood vessels was found, specifically, the gluteal vein.

In these cases, fat was found obstructing medium and large vessels, such as the vena cava, right cardiac cavities, and pulmonary tissue (Figs. 1, 2, 4 and 7 through 9). In contrast, patients who died during the first 24 hours after surgery had a less evident embolism, observed in small pulmonary vessels using special dye for fat tissue. These data guide us toward understanding the difference between these two manifestations, which are different but have the same causal agent, fat in the bloodstream. It is important to emphasize that the amounts of fat infiltrated were not large volumes, with the largest amount being 300 cc per buttock, with an average of 214 cc. We consider that the main factor causing the problem is the muscle area where fat is injected. At the time of autopsy, fat was found in the deep muscle tissue near the vessels, with rupture of venous vessels.

Mortality studies on buttocks fat infiltration are controversial and insufficient. The diagnosis of fat embolism cannot be established easily with clinical studies, laboratory tests, or pathologic evaluation. Therefore, the diagnosis is often only suspected, when the cause cannot be determined.^{1–15,38–45} Many cases with a diagnosis of death from unknown cause or exacerbation of a disease may be related to fat embolism, which would increase the percentage of mortality attributable to this cause. The fat globules that enter the circulation during surgery may have obstructive, inflammatory, and immune effects, and the amount circulating, inflammatory diseases, and patient sensitivity are responsible for the magnitude of the response.^{46–48}

This study shows through necropsy the presence of fat in large, medium, and small vessels secondary to gluteal lipoinjection. This confirms that buttocks lipoinjection can lead to entry of fat into the gluteal vessels, which affects the pulmonary vessels, which results in heart failure and can cause death. It is evident that this is only possible if the fat is injected into a highly vascularized area, such as muscle. Therefore, the indication of intramuscular lipoinjection to achieve gluteal contour improvement is a procedure that must be performed very carefully, avoiding fat injection deep into the muscle. Efforts should be made to inject the fat only into the subcutaneous area, and in superficial muscle planes. To achieve this, we must keep the cannula always parallel to the gluteal surface to avoid entering the subpyramidal or suprapyramidal channels where gluteal vessels are located.

CONCLUSIONS

Lipoinjection is a multifaceted surgical procedure. Its performance and technique are

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completely different, depending on the area treated and the required objective. Lipoinjection in the intramuscular tissue contributes to survival of the adipocyte but also increases the morbidity of the procedure, which in the case of the gluteal area is often fatal. Gluteal lipoinjection is a surgical procedure with excellent results, and although fat survival is greater when injecting it into muscle, its injection into muscular tissue increases the risk of a fat embolism syndrome or fat embolism because of damage of gluteal vessels, the consequences of which are usually very serious. Therefore, intramuscular lipoinjection in the gluteal area is a procedure that should be performed very carefully to avoid injury to the deep gluteal vessels.

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AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES

AQ1—Affiliations correct?

AQ2—Mexican plastic surgeons OK. If not, please provide formal name of organization

AQ3—Citations for Figures 1 through 10 have been edited to 1 through 9 throughout. Please confirm.

AQ4—From the editorial office: Of the final three figures in the original version of this manuscript, only one was included in the revised version. Do we have the right figure, and do we have the right legend for it?

AQ5—Table 1 title OK? If not, please revise as needed.

AQ6—Table 1, bottom row: ± 0.5 and ± 8.2 correct for both Height and Weight columns?

AQ7—citrine correct?

AQ8—OK to cite reference 22 here? If not, please cite in the correct place

AQ9—Sentence that begins “This confirms that buttocks...” OK as edited?

AQ10—Ref 11: Reference correct as edited? Also, please provide month, day, and year on which web site was accessed

AQ11—Please double-check the financial disclosure statement to confirm that it is correct. If it is incorrect, please revise as needed.