

Lipoaspiration and Its Complications: A Safe Operation

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Although lipoaspiration has been considered a safe surgical procedure for the last 30 years, reports indicate that this procedure has a high index of complications. This study was performed to analyze experience with patients in a clinical practice for the past 8 years who underwent lipoaspiration, either alone or in combination with another surgical procedure, and to compare the results with previous reports in the literature. The patients were divided into four groups: lipoaspiration alone of less than 5 liters, lipoaspiration alone of more than 5 liters, lipoaspiration combined with abdominoplasty, and lipoaspiration combined with another surgical procedure. Complications were divided into minor or major, depending on previous reports, and statistical analysis was used to determine any significant difference among the four groups. From January of 1994 to December of 2001, 1047 patients underwent lipoaspiration, either alone or in combination with another surgical procedure. A 21.7 percent incidence of minor complications was noted, as well as a 0.38 percent incidence of major complications. Minor complications included palpable and visible irregularities, seromas, cutaneous hyperpigmentation, overcorrection, cutaneous slough, and local infection. Major complications included fat embolism syndrome, cutaneous necrosis, and extended infection. No statistical difference was noted among the groups studied. The incidence of complications was similar to that in clinical reports in the world literature, being of a low percentage rate when compared with the reports of other types of surgical procedures. On the basis of these results, lipoaspiration continues to be a safe surgical procedure, but to maximally avoid complications, one should be mindful of all the factors that could predispose to them. (*Plast. Reconstr. Surg.* 112: 1435, 2003.)

During the last decade, lipoaspiration has been the most common aesthetic surgical procedure performed in the United States.¹ This incidence has grown considerably through the

years.^{2,3} At the same time, this procedure has been modified in important ways, including technological advances and variations on the surgical technique.⁴⁻⁷ This evolution has required that the surgeon constantly actualize and modify personal concepts and procedures. As with any surgical procedure, lipoaspiration is not exempt from complications, especially when so many modifications are constantly being presented.⁸⁻¹² The complication rate, however, has not increased enough for the procedure to be considered unsafe.¹³⁻²⁰ We present in detail our tumescent technique used in lipoaspiration, as well as the incidence of complications during an 8-year period. We also analyze the possible causes of these complications and how to prevent them.

PATIENTS AND METHODS

During a period of 8 years, from January of 1994 to December of 2001, 1047 patients (958 female patients and 89 male patients) underwent the lipoaspiration procedure. The age range was 16 to 63 years (median age, 32.6 years). All the patients underwent suction-assisted lipoaspiration with an extraction of at least 500 cc. The patients underwent lipoaspiration either as an isolated surgical procedure or in combination with one or more other procedures. Lipoaspiration was performed with a tumescent technique according to previous works.²¹⁻²³ In performing lipoaspiration, neither internal nor external ultrasound was used. All patients received a complete preop-

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erative evaluation, including blood sampling and, if medically indicated, cardiologic evaluation with electrocardiography. A blood autotransfusion was administered to all patients for whom an aspirate of more than 10 liters was anticipated or who were undergoing a combination of surgical procedures with an extraction of more than 8 liters. For these patients, autologous blood was extracted 10 to 14 days before the procedure. All patients receive a preoperative antibiotic prophylaxis 6 hours before the procedure, preferably using first-generation or second-generation cephalosporin. All of the areas treated with lipoaspiration were marked preoperatively with the patient standing. Before the procedure, the patient received approximately 1 liter of isotonic saline with 5% glucose solution to ensure hydration. Anesthesia was administered via a continuous peridural blockade; the peridural was left in place for postoperative analgesia for 24 hours. In none of the cases was general anesthesia or sedation with local anesthesia used during the surgical procedure. Tumescence is accomplished using only one ampule of adrenalin per liter of infiltrated isotonic saline solution. The total infiltrated quantity is greater than the expected lipoaspiration extraction.

Lipoaspiration is exclusively performed in two positions: the ventral decubitus position and the dorsal decubitus position. After positioning the patient in the dorsal decubitus position, a urinary catheter is placed to control fluids. Lipoaspiration is performed in a combined and simultaneous manner by two plastic surgeons who are always under the direction of the chief surgeon. Stems used are no larger than 5 mm in diameter; the ones used most often are 3 and 4 mm. The operation is always performed using a cross technique with various incisions, starting in the deep plane and ending in the superficial plane using the thinnest stems. Homogeneity and regularity of the flap are determined by using the pinch test and by observing the thickness of the skin flap over the stem. Hydration is managed during the operation with crystalloids. Liquid intravenous reposition is approximately 300 cc per liter of lipoaspirated material. This quantity is adjusted according to the calculated bleeding, urinary volume, age, body mass of the patient, hematocrit, and the ratio of infranatant and supranatant liposuctioned material. If autologous blood is used, it is administered during the first postoperative hours.

After the operation, small drains are left in the incisions for several days to help eliminate fluids. We use postoperative compression with a cotton bandage, which is changed to a girdle 5 days after the procedure. The patient remains hospitalized for at least 24 hours for fluid administration and observation. Fluid administration fluctuates at around 3 liters in a 24-hour period. Postsurgical external ultrasound therapy is initiated on approximately the fifth day, using 2.5 W/cm² three times a week for 3 weeks. Later, subdermic therapy with Endermologie is initiated.

We used the chi-square test to determine whether significant differences existed among the groups that were treated with different surgical procedures.

RESULTS

During an 8-year period, 1047 lipoaspiration procedures were performed using the tumescent technique. In 445 patients (42.5 percent), lipoaspiration of 5000 ml or more was the only surgical procedure. In 210 patients (20.1 percent), lipoaspiration between 500 and 4999 ml was the only surgical procedure performed. In 212 patients (20.2 percent), thoracoabdominal circumferential lipoaspiration was performed combined with abdominoplasty. In 180 patients (17.2 percent), lipoaspiration was performed together with another aesthetic procedure other than abdominoplasty (Table I). For a patient to be included in this study, the total aspirated material had to be more than 500 ml. The volume of aspirated material ranged from 500 to 22,200 ml (median, 6230 ml). Female patients constituted 91.4 percent of the patients (male patients, 8.6 percent). According to the reported complications from different authors, complications were categorized as either minor or major.^{13,14} There were no complications in 816 patients (77.9 percent). Minor complications were noted in 227 patients (21.7 percent). Four patients (0.38 percent)

TABLE I
Characteristics of the Surgical Procedures

Type of Lipoaspiration	No.	Percentage
Lipoaspiration alone of more than 5 liters	445	42.5
Lipoaspiration alone of less than 5 liters	210	20.1
Lipoaspiration combined with abdominoplasty	212	20.2
Lipoaspiration combined with another aesthetic procedure	180	17.2
Total	1047	100

had major complications (Table II). The number of minor complications was similar in all the study groups, with no significant statistical differences (Table III). Of the four patients who experienced major complications, two patients (0.19 percent) had fat embolism syndrome, one patient (0.09 percent) had cutaneous necrosis in different areas of the liposuctioned area, and one patient (0.09 percent) had an infection that affected a large area in the lumbar region. All the cases resolved satisfactorily. The two patients who had fat embolism syndrome had undergone lipoaspiration in combination with other surgical procedures. Both patients received gluteal lipoinjection. Abdominoplasty was performed in one patient, and the other patient received breast implants. Cutaneous necrosis occurred in a patient who had had two previous liposuctions. The infection appeared on the twelfth postoperative day in a patient who had lipoaspiration with abdominoplasty. The infection was localized on the drainage areas of the lumbar region. The drains were removed on the sixth postoperative day (Table IV). Of the 227 patients with minor complications, 77 patients (7.36 percent of 1047 patients) presented with palpable irregularities and 46 (4.39 percent of 1047 patients) had visible irregularities. Of the patients with visible irregularities, 34 patients (3.25 percent of 1047 patients) had minor irregularities, whereas 12 patients (1.15 percent) were considered to be overcorrected. Fifty-four patients (5.16 percent of 1047 patients) developed seromas that had to be drained on at least one occasion. Forty-five patients (4.3 percent of 1047 patients) experienced hyperpigmentation in the lipoaspirated region or in the incision used for lipoaspiration. Four patients (0.38 percent) experienced superficial cutaneous compromise, and one patient presented a local infection in a small area in the lumbar region (Table V).

DISCUSSION

Lipoaspiration is undoubtedly one of the surgical procedures that has revolutionized

TABLE II
Complications by Quantity

Complication	No.	Percentage
None	816	77.9
Major	4	0.38
Minor	227	21.7
Total	1047	100

TABLE III
Complications by Type of Procedure

Type of Lipoaspiration	No. of Complications	Percentage
Lipoaspiration alone of more than 5 liters	106 of 445 patients	23.8*
Lipoaspiration alone of less than 5 liters	40 of 210 patients	19*
Lipoaspiration combined with abdominoplasty	48 of 212 patients	22.6*
Lipoaspiration combined with another aesthetic procedure	33 of 180 patients	18.3*

* No significant difference.

plastic surgery. In the last three decades it has become the most common aesthetic procedure in the United States, its frequency increasing significantly year by year.^{2,3} This growth has been accompanied by substantial changes in the manner in which the procedure is performed as well as progress in the technology that is used to perform it.⁴⁻⁷ Its worldwide popularity is high because of the great advantages it affords, such as aesthetic improvement,^{24,25} and because of all the metabolic benefits that have begun to be documented.^{26,27} As with any surgical procedure, however, lipoaspiration is not exempt from complications, especially with all the multiple refinements the procedure has undergone.

Recently, reports such as those from Rao et al.²⁸ have emerged with alarming information about deaths accompanying lipoaspiration. Despite the fact that for the last 30 years lipoaspiration has been considered a safe surgical procedure,¹³⁻²⁰ these reports have generated diverse reactions and controversy.²⁹ Some authors indicate the presence of important complications,²⁹ while others emphasize the safety of the procedure and the deficiencies that exist in the Rao et al. study.²⁹⁻³⁴ Some authors indicate the presence of important complications,²⁹⁻³¹ whereas others emphasize the safety of the procedure and the deficiencies that exist in Rao et al.'s work.³²⁻³⁴ Through the years, the majority of the world medical literature has shown that lipoaspiration is a safe surgical procedure,¹³⁻²⁰ and this agrees with our results. Because of the controversy that has been generated around complications, we considered it important to demonstrate our experience, and to analyze the most frequent complications reported in the world literature with their possible causes and preventions.

Through the years, complications have been

TABLE IV
Major Complications ($n = 1047$ patients)

Type of Complication	No. of Patients	Percentage	Remarks
Fat embolism syndrome	2	0.19	In both patients, minor lipoaspiration was combined with gluteal lipoinjection. One patient also had abdominoplasty and the other one received breast implants
Cutaneous necrosis	1	0.1	Patient had two previous liposuctions
Extended infection	1	0.1	Late infection in the area where the drains were placed
Total	4	0.38	

categorized as major or minor.^{13,14} The major complications are those that are life threatening, and these should be avoided at all cost. A major complication should not be viewed as merely a statistical average for the surgical procedure; a major complication is an alarm signal, although occasionally it is not synonymous with an incorrect surgical technique.

Our complications have been reported in the world literature.^{13,14,16,20} In our minor complications, we also included all the visible and palpable irregularities. These irregularities are present mostly in patients who have had large volumes of material liposuctioned, which includes many of our patients. Seromas are complications that have increased in frequency because of the use of the tumescent technique to improve lipoaspiration. Our incidence of seromas has decreased considerably from the moment we started to use drains, which should be removed only when the drainage is practically nil. We used to have seromas in approximately 10 percent of our patients when drains were removed on the second or third day after the procedure. At present, by leaving drains in place for more than 5 days, the percentage of seromas has decreased to less than 1 percent. Care should be taken to prevent ascending contamination through drains, because contamination was present where the drains were

placed in one of our major complications and in another minor complication. This contamination can be avoided if the patient is informed about how to clean and take care of the area where the drains are located until they are removed.

The irregularities, palpable or visible, including overcorrection, could be due to the use of wide stems in nonindicated planes. The use of thin stems is the isolated principal factor that significantly decreases the presence of irregularities. By initially liposuctioning the deeper plane, and later the superficial plane, and then using the pinch maneuver while observing the skin flap thickness over the stem, our results have become more uniform. If we are more conservative and use these principles, overcorrection will be rare. An important note surrounding irregularities is that it is not always caused by a wrong surgical technique. On many occasions, the irregular cutaneous retraction, especially in patients who have large major flaccidity or in those who have had large volumes liposuctioned, is the most common cause of irregularities and should not be considered as a complication but as a concomitant consequence of the procedure in this type of patient. This same concept is shared with other authors.²⁰ The use of postoperative external ultrasound and Endermologie has considerably decreased the presence of irregularities.

Cutaneous hyperpigmentation could be due to friction burns at the site where the stem is introduced or by the secondary deposits of hemosiderin in the skin at the site of bruises. The use of drains helps to avoid the formation of bruises, while a slightly larger incision has decreased the presence of hyperpigmentation at the site of incisions. Undoubtedly, the presence of cutaneous compromise is due to skin traumatization from stems or to pinching of the skin while working. For these reasons, our maneuvers must be as gentle as possible; also,

TABLE V
Minor Complications ($n = 1047$ patients)

Type of Complication	No. of Patients	Percentage
Palpable irregularities	77	7.36*
Seromas	54	5.16
Cutaneous hyperpigmentation	45	4.3*
Visible irregularities	34	3.25*
Overcorrection	12	1.14
Cutaneous slough	4	0.38
Local infection	1	0.1
Total	227	21.7

* For many patients, these complications must be considered as an undesirable aesthetic outcome rather than a complication.

postoperative compressive dressings should not be so tight as to compromise the vascularity of the skin flap. Care must be taken, especially in those patients who have had one or two liposuctions in the surgical area, because these patients are prone to cutaneous compromise with necrosis due to injury to the vascular plexus produced by previous lipoaspiration.

Our incidence of major complications was low. We attribute this to the integral management we give to the patient, preoperatively, intraoperatively, and postoperatively. We never consider lipoaspiration a minor or ambulatory procedure. All of our patients are evaluated clinically, even cardiologically if necessary. All of our procedures are performed in the operating room, and patients are always under the supervision and management of an anesthesiologist. We have never had a case of lidocaine toxicity because we never use lidocaine in our tumescent infiltrations. Anesthetic management is obtained by use of a continuous peridural blockade, which is useful also for postoperative analgesia. We have never had a case of fluid overload because fluid control is strictly observed; we always take into account the amount of the infiltrate, the amount extracted, and the urinary output. Problems arise when inexperienced physicians consider that because they extract large volumes with lipoaspiration, they need to replace fluids intravenously with large volumes. We should avoid this by using existing formulas³⁵ and checking intraoperative clinical parameters. The use of lower extremity compression and ambulation during the first 24 hours helps to prevent thrombophlebitis and pulmonary thromboembolism. We have never experienced an urgent complication intraoperatively or in the immediate postoperative period. By performing the procedure using two surgeons, we significantly reduce the surgical time, which we consider an important factor in our low incidence of complications. We do not believe that, based on economic aspects or marketing, the patient should be released from the hospital the same day of a lipoaspiration procedure.³⁶ We hospitalize our patients for a minimum of 24 hours to supervise and replace fluids, which permits us to have careful postoperative control over our patients.

Special attention should be given to our most important complication following lipoaspiration: fat embolism syndrome. In our two patients, the clinical presentation was char-

acteristic,^{37,38} initializing 36 hours postoperatively and after discharge from the hospital. In both patients, lipoaspiration was performed in combination with gluteal fat infiltration for aesthetic reasons. In both patients, the lipoaspirated volume was less than 3000 ml and fluid deficit was present, secondary to postoperative vomiting at home. The cause of the complication in these patients is controversial, but when the complication is attended to in an appropriate and aggressive manner, the prognosis is favorable.^{39,40} We believe, on the basis of studies we will publish shortly and of previous study data,²⁵ that during lipoaspiration and lipoinjection, fatty material enters the circulatory system and could initiate this syndrome. It is essential, therefore, to administer fluids intravenously for a minimum of 24 hours postoperatively to clear the circulatory system of fatty material.

Lipoaspiration should be considered a safe surgical procedure. The majority of publications and clinical works consider this procedure safe.¹³⁻²⁰ Undoubtedly, the presence of complications could constitute alarming data.^{8-11,28-31} All the factors contributing to these complications must be analyzed, and many of them have been considered in this article as well as in other works.^{15-17,41} Some form of complication is inherent in any surgical procedure. We should not forget that the number of complications will always be large when a surgical procedure such as lipoaspiration is performed extensively throughout the world. As with any surgical procedure, the teaching and learning process, as well as surgical skill, are essential, not only for the surgeon but for the entire surgical team, to maximally decrease complications. Lipoaspiration is not a procedure that should be performed by unskilled surgical teams. Similarly, patient selection and evaluation using the best surgical judgment as to how the procedure should be performed are fundamental factors for the success of this procedure with a minimal number of complications. Lipoaspiration is the only procedure that, after a vertiginous increase throughout the last 10 years, has decreased drastically in United States.⁴² Its increase from 1992 to 2001 was 313 percent, but there has been a decrease of more than 15 percent in the last 2 years, even though the majority of aesthetic procedures are being performed more frequently.⁴² Undoubtedly, this decline is a result of the bad publicity that has accompanied such a gratifying procedure

as lipoaspiration. So it should fall to us, as expert surgeons using excellent medical care and judgment, to restore the credibility that lipoaspiration has unjustly lost.

CONCLUSIONS

Although lipoaspiration has been considered a safe surgical procedure for the last 30 years, there have been reports indicating that this procedure has a high index of complications. We present our compilation of complications during an 8-year period in which 1047 patients underwent lipoaspiration, either alone or in combination with another surgical procedure. During this period, we experienced a 21.7 percent incidence of minor complications, and a 0.38 percent incidence of major complications. This incidence is similar to that in clinical reports in the world literature—a low percentage rate when compared with the reports of other types of surgical procedures. We analyzed and compared our complications with the most frequent complications reported in these journals, indicating the factors and characteristics that could influence their appearance. Similarly, we analyzed the way we could prevent these complications. On the basis of these results, we believe that lipoaspiration continues to remain a safe surgical procedure, and that we should be mindful of all the factors that could predispose to complications, so that we can avoid them.

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