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Surgical Correction of Abdomen Irregularities after Liposuction: Case Series

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Background: The occurrence of surface irregularities in the abdomen after liposuction is frequent and can be due to the fact that more liposuctions are being done nowadays, and perhaps, the fact that more noncore surgeons are doing it could be an important factor. These superficial changes compromise the aesthetic results of surgery, and their correction is a major technical challenge.
Methods: The author presents a systematized approach for surgical treatment of fibrosis and post liposuction irregularities. Twenty-three patients underwent liposuction and abdominoplasty or mini abdominoplasty by a single surgeon (G.B.B.) over a period of 24 months to correct superficial abdominal wall irregularities after previous liposuction. All patients underwent evaluation through digital photography by two independent senior plastic surgeons according to an objective aesthetic outcome scale, 12 months after the operation.
Results: All 23 patients showed an improvement in the appearance of the abdominal wall according to the aesthetic outcome scale used. Eighty-seven percent of the patients operated on in this series had previously undergone liposuction using technologies and 4.3% underwent liposuction alone. The overall minor complication rate was 26%. No major complications were noted.
Conclusions: The combination of liposuction, direct fibrosis removal, and flap tensioning (abdominoplasty or mini abdominoplasty) could correct in this series the multiple factors (fibrosis, skin laxity, residual fat deposits post liposuction) related to abdominal wall surface irregularities in a safe, effective, and reproducible manner.
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INTRODUCTION

The occurrence of surface irregularities in the abdomen after liposuction, whether combined with abdominoplasty or the use of external energy devices/technologies, has increased in frequency and intensity.[1–4] These superficial changes, which compromise the aesthetic result of surgery, are a major technical challenge, as their solution depends on the correction of multiple causal factors. Post liposuction irregularities can be in the form of dimples, grooves, wrinkles, or folds and can be worsened by the association of skin laxity.[3]

Most patients have already been subjected to several long noninvasive treatments without success. Specific surgical treatment is the only effective solution to alleviate aesthetic damage.

In this series, the authors present a systematized approach for the surgical treatment of fibrosis and post liposuction irregularities of the abdominal wall caused by liposuction alone, combined with mini abdominoplasty and/or the use of technology.

METHODS

This was a retrospective study from a single center, performed for 24 months (September 2020 to December 2022) in accordance with the Declaration of Helsinki, and written informed consent was obtained.

Over a period of 24 months, 23 patients underwent liposuction and abdominoplasty to fix subcutaneous abdominal wall irregularities after liposuction. A follow-up evaluation was performed 12 months postoperatively. All patients underwent evaluation through digital

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photography by two independent senior plastic surgeons according to an objective aesthetic outcome scale[5]

Inclusion Criteria

Patients with previous liposuction (minimum 6 mo postoperatively) combined with or without mini abdominoplasty, abdominoplasty, or use of any type of energy, such as ultrasound, plasma, radiofrequency, laser, and presenting fibrosis and irregularities were included in the study.

Decision-making Algorithm

The algorithm in Figure 1 was developed in order to make it easier to decide which technique is the most adequate to solve each case, and it is based on anatomical findings.

Surgical Technique

Suction-assisted Liposuction

Suction-assisted liposuction or superficial liposuction was performed under regional anesthesia (epidural block) and sedation. The tumescent technique was performed using a 3-mm cannula at a concentration of 1:500,000 epinephrine to achieve adequate vasoconstriction.

A regular perforated liposuction cannula with three holes in a line on one side of the tube (sizes 3.5 and 4 mm) was used to perform liposuction. This cannula design is important to spare the subdermal plexus during superficial liposuction (Fig. 2).

Liposuction is always performed before abdominoplasty or mini abdominoplasty. The objective of this multilayer approach is to remove nonuniform fat deposits related to previous surgery. The deepest sub-Scarpa areas are liposuctioned with 4-mm-diameter cannula. The 3.5-mm-diameter cannulas are indicated for more superficial liposuction for finishing when necessary. It is very important to avoid using cannulas with ports facing up to the dermis. Otherwise, subdermal plexus damage may occur.[6]

The objective was to create a thinner flap of homogeneous thickness to remove specific fat deposits responsible for the local volume irregularities.

Abdominoplasty

Abdominoplasty was performed after liposuction using an incision at the suprapubic area (6 cm from the furcula vaginalis) and tissue detachment up to the xiphoid process through a tunnel beyond the lateral edges of the rectus muscle, whenever necessary, to achieve adequate tissue release with minimal tension or retraction and total belly muscle exposure.

The authors highlighted that flap dissection can be very laborious because fibrosis creates a scarring plastron, distorting the original anatomy. Monopolar electrocautery was used to undermine tissues.

After broad and adequate detachment, the mobility and distensibility of the flap must be assessed because scar adhesion can prevent its descent. When this occurs, the authors carefully perform direct removal of scar fibrosis adjacent to the flap to avoid damage to the subdermal plexus. In cases where the fibrosis pattern is flat and only prevents traction of the flap, the authors make direct relaxing horizontal incisions (as many as necessary) with a blade or scissors, guaranteeing tension-free traction. [**See Video 1 (online)**, which shows relaxation incisions in a flap with flat pattern fibrosis.] However, fibrosis sometimes seems voluminous. In these cases, the authors must make chessboard incisions in the bulky tissue and remove each of the fibrosis "cubes" to ensure tissue with homogeneous thickness and without tension. [**See Video 2 (online),** which shows the direct resection of voluminous fibrous tissue, after chessboard incisions. Obviously, these

Takeaways

Question: How can we correct irregularities from previous liposuction and technology?

Findings: The study shows that a special type of abdominoplasty is effective in correcting these irregularities and fibrosis.

Meaning: Surgical way to correct liposuction irregularities.

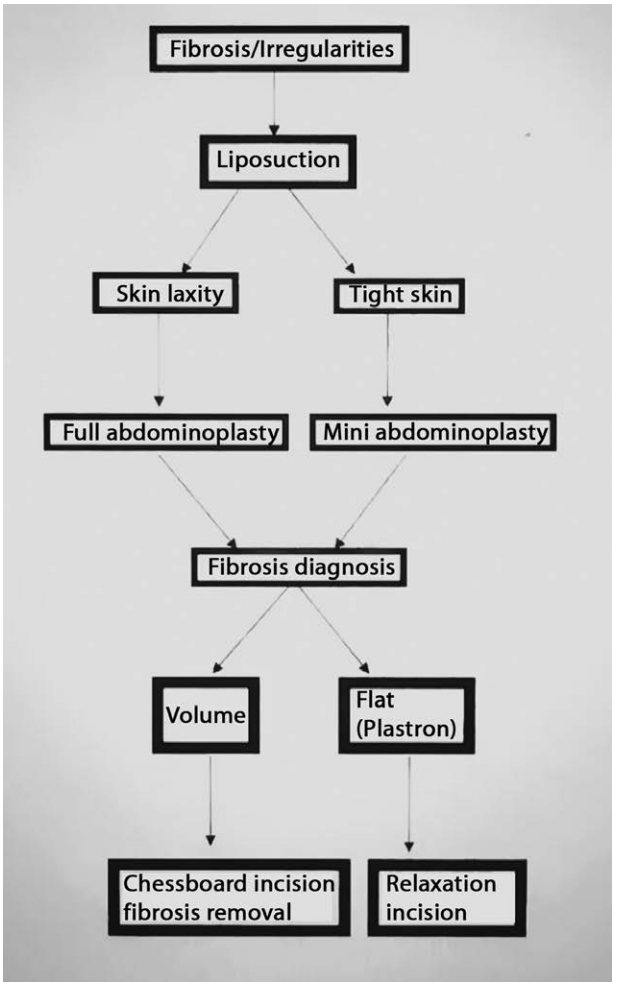

Fig. 1. Decision-making algorithm.

Fig. 2. Example of liposuction cannula with 3 in line holes.

maneuvers require strict control such that only fibrous tissue is removed without damaging the adjacent vascular subdermal plexus.[5,6] To improve the flap connection, eliminate dead space, and reduce tension in the distal part, 2-0 Vicryl quilting sutures were used.

Mini Abdominoplasty

Mini abdominoplasty was indicated, despite fibrosis and irregularities, when there was no sagging skin in the upper abdomen. The approach follows the same principles as abdominoplasty regarding the tissue undermining and muscle plication.

Abdominal Pads

Compression is one of the main pillars of medium definition liposuction. Immediately after the procedure, customized hand-crafted cotton and gauze pads were prepared in the operating room and placed on specific sites of the abdomen to produce localized pressure areas of contact between the skin, subcutaneous tissue, and the underlying fascia (Fig. 3A). A traditional liposuction compression garment is placed over the abdominal pad.

After 48 hours, the patients removed the original compression pads and received a removable custom compression pad. This second compression pad/second compression garment could be removed so that the patient could bathe normally and then reposition it. It was recommended to be used by the patient for at least 1 month after surgery. The use of these shaping pads is critical for achieving optimal long-term aesthetic results.[6,7]

Suction Drains

All the cases used suction drains for 8 days.

RESULTS

All patients were women, and the mean age of the patients was 33.4 years (26–43 y). Follow-up evaluation was performed 12 months postoperatively in all patients.

Twenty-three patients underwent surgery to correct fibrotic scar changes after liposuction (with or without the previous use of energy devices) by the same surgeon (G.B.B.).

According to Strasser scale, all 23 patients achieved improvement in the appearance of the abdominal wall with near-total resolution of irregularities and fibrosis. Three patients still had residual irregularities despite improvement in the appearance of their abdomen.

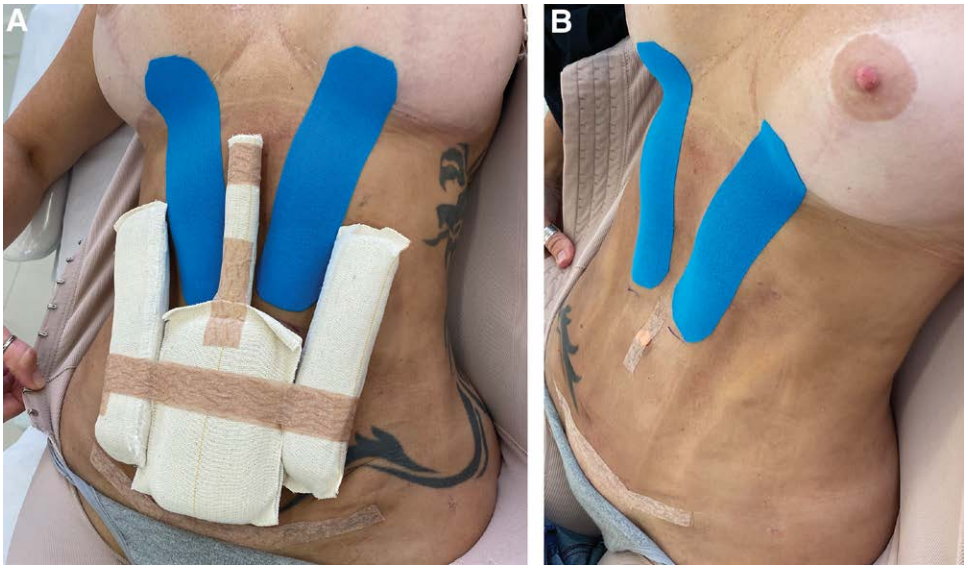

Fig. 3. Compression pads. A, Example of abdominal pad. B, Negative areas created by the abdominal pad.

Table 1. Distribution of the Sample according to the Type of External Energy/Technology Previously Used Combined with Liposuction

	Energy Devices/Technologies + Liposuction			
	Ultrasound VASER	Radiofrequency BodyTite	J Plasma Renuvion	Unknown
Fibrosis/Irregularities, n = 20	4 (20%)	1 (5%)	12 (60%)	3 (15%)

Table 2. Complications

Complications	**n = 6 (26%)**
Seroma	1 (4.3%)
Dyschromia	1 (4.3%)
Residual irregularities	3 (13%)
Distal flap epidermolysis	1 (4,3%)

Most patients presenting with fibrosis and irregularities underwent liposuction in combination with technologies (20, 87%) and are listed in Table 1. Three patients underwent liposuction without energy and three patients underwent mini abdominoplasty in association with liposuction and technologies. Seven patients underwent a previous nonsurgical treatment in an attempt to treat fibrosis/irregularities such as external ultrasound and enzyme injections without success. All 23 patients were previously operated by different board-certified plastic surgeons.

The most frequent complications (6; 26%) are shown in Table 2. One seroma case was present at the 11th postoperative day and was treated by ultrasound-guided aspiration. No infection, necrosis, or major complications were observed (Fig. 4A, B for case 1; Fig. 5A, B for case 2; Fig. 6A, B for case 3; and Fig. 7A, B for case 4, with 12-month follow-up).

DISCUSSION

Ten years ago, the series showed a rate of approximately 8% of superficial abdominal irregularities after liposuction. Today, this rate varies across studies from 5% to 19%.[1,2,4,8,9] However, more importantly than frequency, today, we have seen more intense irregularities and distortions in cases and atypical location patterns, which were not identified in the past. As a reference center, we receive increasingly challenging and difficult-to-solve cases.

According to the literature, post liposuction surface irregularities or waviness could be caused by the following:

1. Inappropriate use and/or complications related to external energy/technology (ultrasound, plasma, radiofrequency, laser);
2. Loss of tissue tension/sagging after liposuction (redundant skin and inappropriate compression garment or posture);
3. Uneven liposuction (poor technique);
4. Mixed causes.

The use of external energy technologies (ultrasound, plasma, radiofrequency, laser) can promote variable and sometimes unpredictable degrees of subcutaneous tissue retraction, regardless of the mechanism of action, and some degree of thermal energy is generated, acting on the fibroseptal network or interstitial connective tissue. Thermal energy promotes coagulation, dehydration, and protein denaturation of these structures, causing scar shortening, and consequently increasing the tension and traction of adjacent tissues. Unfortunately, the inappropriate use and misindication of these tools can have disastrous consequences, such as burns and tissue necrosis. In addition, minor complications have been described, such as seromas, cutaneous dyschromia, and varying degrees of fibrosis/irregularities.[10–12]

One of the primary factors in subcutaneous irregularities of the abdominal wall is loss of tissue tension after liposuction. This liposuctioned tissue, which is now more flaccid and redundant, may fit in a disorderly manner to

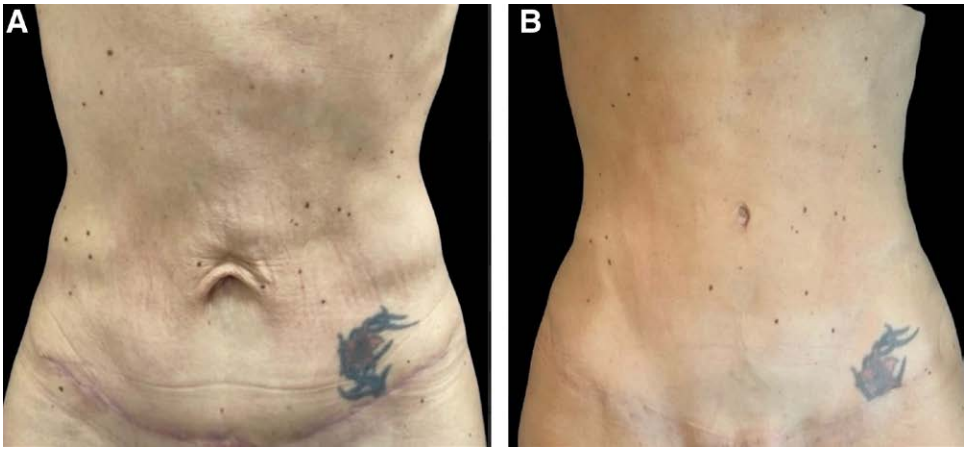

Fig. 4. A 34-year-old woman. A, Preoperatively: 6 months after liposuction, Renuvion, mini abdominoplasty. B, Twelve months postoperatively: liposuction + fibrosis removal + full abdominoplasty.

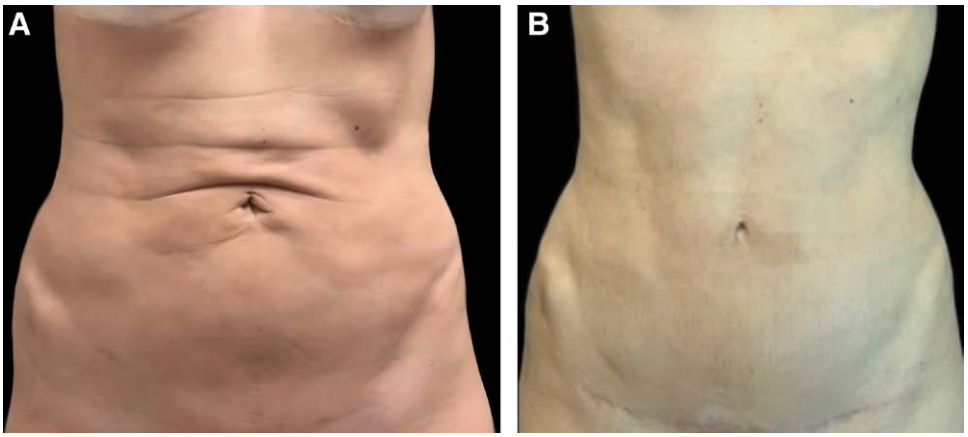

Fig. 5. A 37-year-old woman. A, Preoperatively: 1 year after liposuction, Renuvion. B, Twelve months postoperatively: liposuction + fibrosis removal + mini abdominoplasty.

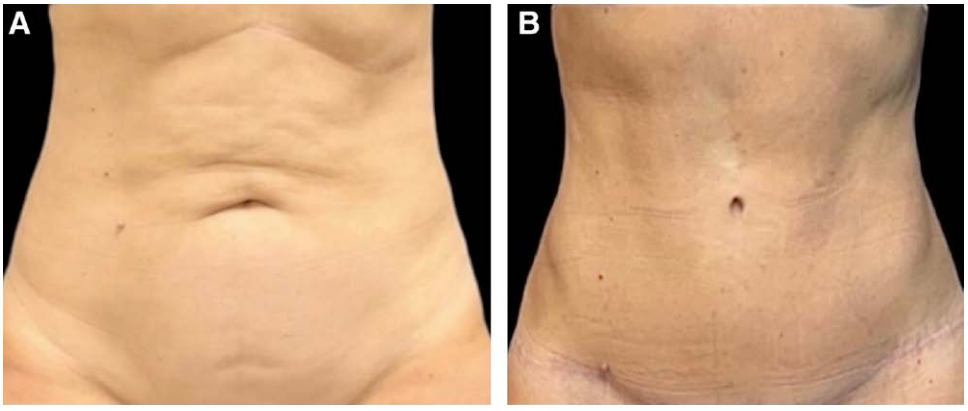

Fig. 6. A 39-year-old woman. A, Preoperatively: 9 months after liposuction, BodyTite. B, Twelve months postoperatively: liposuction + fibrosis removal + full abdominoplasty.

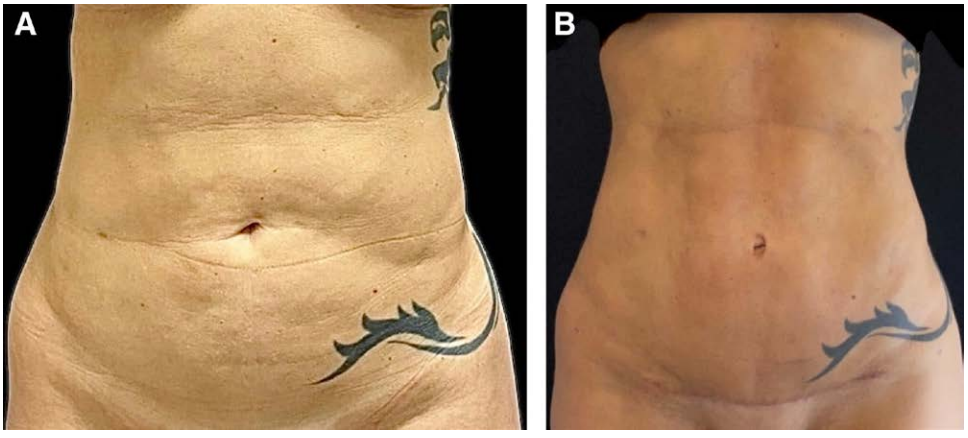

Fig. 7. A 36-year-old woman. A, Preoperatively: 1 year after liposuction, VASER. B, Twelve months postoperatively: liposuction + fibrosis removal + mini abdominoplasty.

the deeper muscular aponeurotic layer. This "accommodation"/adhesion will depend on factors, such as quality and thickness of the dermis, homogeneity of flap thickness, and external compression elements (a well-fitting garment enhances skin retraction, whereas an ill-fitting garment, especially associated with bad posture, can lead to surface irregularities).[3,5] These areas have different adhesion/connection points into the deeper layers,

presenting regions with different volumes due to the irregular space that allows the loose connective tissue to form there, to evolve into a voluminous scarring fibrosis, alternating with areas of adhesion without volume.

An inadequate technique of conventional liposuction (without the use of external energy devices) can generate nonuniform removal of fat from the subcutaneous layer, causing tunnels with different amounts of residual fat at different depths. These deep areas, with different volumes, can imprint their shape on the skin, which manifests itself through imperfections with varying aspects (nodules, plaques, asymmetries, cannula path marks, and depressions). Furthermore, more superficial and aggressive liposuctions, in addition to eventually causing the irregularities mentioned above, can damage the subdermal plexus, triggering a localized scarring process of deep adhesions with tissue distortion, dyschromia, and even ischemic damage/necrosis.[3,4]

The combination of inadequate liposuction techniques (especially related to noncore surgeons), poor treatment indication/patient selection, and improper use of technologies can increase tissue damage and is probably the most frequent cause of irregularities in the tissue covering the abdominal wall. Excessive superficial liposuction to highlight areas of muscular transition is responsible for scarring changes and the formation of fibrous cords that can be perceived visually and on palpation. This uneven tissue cover, related to Scarpa fascia damage, can also cause adhesions of the subdermal region to the muscle fascia, causing hard lines, dimples, and distortions. Superficial liposuction associated with the use of technologies may worsen the situation, adding a greater occurrence of seromas and occasionally dyschromia.

In this series, most of the treated patients presented a combination of elements that caused fibrosis and irregularities. The sum of inadequate surgical indications, combined with the use of technologies, was the most frequent found (Table 1). In this series, J Plasma Renuvion was the technology most frequently found concomitantly in cases of fibrosis and irregularities. However, it should be noted that this is the most used technology in the country where this study was conducted. Furthermore, it should be emphasized that energy devices were recently introduced in Brazil (2021), and the learning curve may be related to these findings. It cannot be said that the energy devices were a causal factor, or that any of them can cause a higher rate of scar fibrosis. Table 1 only illustrates this study population, but it does not determine the total universe of patients who underwent liposuction and energy devices.

In this series, only three (15%) patients with fibrosis and irregularities underwent liposuction alone. It is important to highlight that the patterns of irregularities and distortions are different when they do not involve additional external energy, being less intense, and with simpler surgical removal.

Surgical Approach

Although there is no ideal period for surgical treatment, the authors recommend an interval of at least six months after the last surgical intervention. This was confirmed by Danilla et al,[4] who demonstrated approximately 20% of irregularities and tissue indurations due to previous liposuction. However, most patients spontaneously experienced partial or total improvement within 3 months. In this series, the authors realized that the longer the time since the previous surgery, the better the outcome. Therefore, within a minimum period of 6 months, the tissue has already undergone natural changes in scar remodeling, facilitating new surgical interventions.

Surgical treatment aims to partially or completely remove fibrous scar tissue and uneven fat deposits, allowing descent of a flap of homogeneous thickness with minimal tension. Intraoperatively, the use of a small-diameter cannula (3–4 mm) and careful use of the crisscross liposuction technique are recommended to prevent waviness.[3,6] Keeping the cannula hole on the underside of the cannula away from the overlying skin always is extremely important for sparing and protecting the subdermal vascular plexus. During the flap approach and dissection, attention must be paid to distortions of the anatomical planes caused by intense scar reactions. Careful dissection must be performed until complete release of adhesions that cause deep asymmetries and irregularities. Postseroma fibrous capsules are commonly identified in this dissection, which also contributes to local surface inequality and retraction.

There are basically two main patterns of changes that fibrosis generates, which are reflected in the superficial anatomy of the abdominal wall.

1. Cicatricial plastron pattern in a flat, relatively regular adhesion, which pulls the flap surface in varying degrees.
2. Fibrosis with volume that changes the shape and thickness of the flap.

Of course, there are often mixed components between the two. Therefore, it is important to identify these patterns intraoperatively, because the surgical approach is different for each (see Surgical Technique in Methods).

In addition to improving the aesthetic appearance, the removal of fibrosis allows the abdominal flap to recover its distensibility. It is important to highlight that applying excessive traction force to a flap that presents fibrosis can lead to ischemic damage because the scar tissue does not present the same distension and deformation behavior as normal tissue, and it may cause incarceration, kinking, and choking of the nourishing vessels of the flap, leading to necrosis.

Despite the removal of fibrosis potentially causing greater production and fluid collection, we only had one case of small-volume seroma clinically identified on the 11th postoperative day and confirmed by ultrasound, which was treated with an ultrasound-guided aspiration session, evolving to complete resolution. Postoperatively, the combination of suction drains and compression pads in key areas is essential to eliminate any dead space helping in tissue distribution and mechanically guide the healing process and connection of the mobilized tissue along the deeper plane. Furthermore, it is important to reduce fluid collection like seromas and hematomas. According to the authors' own findings and those of Gurtner et al,[13] constant compression can organize the deposition of collagen fibers, controlling the volume and shape of the fibrous tissue.[6,7]

It is important to highlight that this approach requires great surgical skill, mastery of thin flaps, and extreme care of the subdermal plexus. Multilayer liposuction, fibrosis removal, and abdominoplasty in the same procedure enhance the risk flap loss. This technique is the last resort used for the treatment of irregularities and fibrosis that are refractory to other treatments. Measures that improve local vascularization, such as hyperbaric oxygen chambers and local and systemic vasodilators, are highly recommended in all cases.

CONCLUSIONS

The combination of liposuction, fibrosis removal, and flap tensioning (abdominoplasty or mini abdominoplasty) makes it possible to correct multiple factors responsible for abdominal wall surface irregularities using the same procedure. This technical approach proved to be effective for safe and reproducible treatment of fibrosis and irregularities after liposuction in this series

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

Patients provided written consent for the use of their images.

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