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ORIGINAL ARTICLE BODY CONTOURING

Focus on the Importance of Lipomid-Abdominoplasty in the Body Contouring Surgery

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Abstract
Background During the last few years, the surgical principles of abdominoplasty remained unchanged. Therefore, many observed results have misaligned, high and straight abdominal transverse scars, leading to the final positioning of the umbilical scar to be very close to the transverse scar, which gives the impression of a short abdomen. We propose that the abdominoplasty should change the basic conception of its marking, because we believe that it is important to place the transverse scar lower in the medial and pubic region, and higher in the lateral extremities, thus allowing a rotation of the flap of the anterior flanks back lumbar in the median inferior direction.
Materials We analyzed 136 patients with abdominal deformities and subjected them to lipomid-abdominoplasty making a marking with strong upper concavity and lateral sides of the scar oriented to the lower transverse line of the abdomen, 4 cm equidistant from the root of the thigh. We also associate liposuction as a complementary treatment to body contouring.
Conclusions It is important to determine the area of the abdominal deformity and its classification, to establish the strategies of treatment, and association of complementary procedures. A lower marking respecting the treatment areas will allow a better esthetic scar and a harmonic body contour as well as an adequate placement of the elements: umbilical scar, pubis and lateral extremities of transverse abdominal scar.
Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Abdominoplasty · Lipoabdominoplasty · Body contouring · Mid-abdominoplasty · Lipomid-abdominoplasty · Abdominal design · Abdominal marking · Liposuction · Mini-abdominoplasty · Midiabdominoplasty

Introduction

Esthetic abdominal surgery needs a global approach to the body contour; therefore, it is necessary to evaluate the regions and structures that surround it [1, 2]. For example, obesity, significant weight loss, consecutive pregnancies, etc., are causes of abdominal deformation that affect more than one body region [3, 4]. It is also important to determine the presence of predisposing factors: skin flaccidity, localized or generalized lipodystrophy, musculoaponeurotic flaccidity and stretch marks [1, 2, 5], which, together with the determination of the affected areas, will help us to choose the appropriate surgical strategies for their treatment.

Abdominal plastic surgery is a procedure characterized by the total resection of the skin and fat within the infraumbilical region [3], performed without considering the final repositioning of the tissues. This fact leads to a high horizontal scar near the neo-umbilicus, generating the appearance of an amputated abdomen [6].

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Abdominoplasty includes the following elements: a lower transverse incision in the abdomen, a medial dissection until the costal margin, treatment of the rectus abdominis diastasis through plication, abundant abdominal flap resection with a maximum medial resection umbilical transposition and skin closure with flexed hips.

For this reason, we observed outcomes representing true esthetic mistakes resulting in stigmas such as misplaced high and straight scars, resulting from incoherent strategies, to avoid complications such as necrosis or flap suffering. Since most surgeons perform an elliptical resection with greater width in the medial axis, the positioning of the umbilicus very close to the transverse scar has also been observed, which generates the impression of a short, amputated and non-esthetic abdomen. Other observed stigmas are residual flaccidity of the flanks, suprapubic scar depression with soft tissue bulges above and below the incisional scar, excessive displacement of the upper pubic hair and persistence of pubic lipodystrophy.

We propose a new approach to the abdomen, regardless of the amount of skin being resected. What matters is the final scar positioning that must be low. For the final horizontal scar to remain in a low position, it is necessary that the resected segment is smaller, requiring a mid-abdominoplasty. Because it is not possible to remove the entire infraumbilical segment and keep the scar low [7], that is why our resection is partial.

The mid-abdominoplasty known as the "limited abdominoplasty" was proposed and published for the first time by Wilkinson and Swartz [8]. This technique corrected the flaccidity of the skin with a shorter incision which could be placed in the lower abdominal fold. However, the final scars continued straight because of the cuneiform resection of the skin. Subsequently, Ribeiro et al. [7] used the term to describe a technique with little skin resection without becoming a classic abdominoplasty.

The extent of cutaneous resection is defined by the degree of flaccidity or lipodystrophy present in the supra- and infraumbilical segment [5]. Depending on them, we can determine the treatment to follow. Thus, we believe that all the standardized techniques in abdominoplasty are based on mistaken principles because they aim at a larger medial skin resection independently from the pubic area lifting that it may cause, and the high positioning of the final transverse scar. The great stretching of the abdominal flap and the area of greater flaccidity occurs laterally rather than centrally, as in the standard abdominoplasty drawings [9, 10].

We also believe that the association of abdominoplasty with liposuction is an inseparable procedure. It should be done in a balanced and harmonic way to promote a better result and safety, even if the body contouring approach has to be done in several surgical times [11].

In general, discrete or moderate infraumbilical lipodystrophy responds very well to liposuction, invariably followed by a suitable effective cutaneous contraction, in which we can observe a visible improvement of its elastic and structural properties. On the other hand, the supraumbilical skin and adipose component show a marked insufficiency of contraction after liposuction. This contractile incapacity or reduced elastic response of this segment to local liposuction imposes or requires the adoption of methods of resection and cutaneous traction for its better adaptation.

Materials and Methods

We present a retrospective study in which 136 surgeries were analyzed, including 134 female patients and 2 male patients between January 1988 and July 2017 (Table 1).

The most frequent age group varied between 30 and 50 years old, with a predominance between 41 and 50 years old (38% of surgeries).

In the evaluation of the diagnosis of the cases studied, we adopted the isolated observation of each of the three most important elements in the direct or indirect determination of the abdominal shape, as well as the body contouring. These elements are: the skin, the subcutaneous adipose panicle and the musculoaponeurotic complex [2, 5, 6, 8, 12]. For this purpose, pre- and postoperative evaluations were carried out according to the classification of abdominal deformities [6] (Table 2).

We initiate the marking of the mid-abdominoplasty and liposuction with the patient in the supine position. We identify the pubis symphysis and draw a vertical line toward the umbilicus; at a height of 5 cm, we draw a transverse curved line with the concave side in a cranial direction and we extend the transverse lines toward the

Table 1 Characteristics of patients

Age (Mean ± SD, range)	38% (41–50 years)
Woman/man	134 women/2 men (1.47%)
BMI (Mean ± SD, range)	28,582
Surgeries	
	15 abdominoplasty (11.02%)
	120 mid-abdominoplasty (88.24%)
	1 mini-abdominoplasty (0.74%)
Post-bariatric	15% (20 patients)
Complications	7.35% (10 patients)
Total	136 patients

Table 2 Classification of abdominal deformities and their surgical correlations

Category	Skin flaccidity	Lipodystrophy	Flaccidity musculoaponeurotic	Treatment
Group I	Non-cutaneous flaccidity	Light to moderate	No flaccidity	Liposuction
Group II	Light to moderate skin flaccidity in infraumbilical region	Moderate	With or no flaccidity	Mini-abdominoplasty with liposuction
Group III	Light to moderate skin flaccidity in infra and supraumbilical region	Moderate	Moderate flaccidity	Mid-abdominoplasty with liposuction
Group IV	Accentuated cutaneous flaccidity	Moderate or pronounced	Moderate or pronounced flaccidity	Lipoabdominoplasty
Group V	Presence of a medium vertical scar with moderate or accentuated cutaneous flaccidity	Moderate or pronounced	Pronounced flaccidity	Vertical abdominoplasty

lateral ones respecting the inguinal area (Fig. 1a, b). For this, we draw a line at the root of the thigh; from 4 cm in height, we can draw the lateral lines; in this way, we managed to preserve the strong adherence zones, described by Lockwood [9, 10] (Fig. 2). We extend the lateral lines until before the anterior superior iliac spine the calculation will be determined by doing a pinch test.

For the upper marking, we draw a curved line of the central cranial concavity, which will preserve the umbilicus and have an area of lower tension. We also make a convex drawing on the sides to make a greater resection of tissues in the lateral area of the abdomen. This marking is also applicable for cases with less skin resection as in a mini-abdominoplasty. The marking respects the strong adherence zones, and a smaller design is made proportional to the amount of tissue to be resected (Fig. 3a). For cases with greater tissue resection, the curved lines open a little

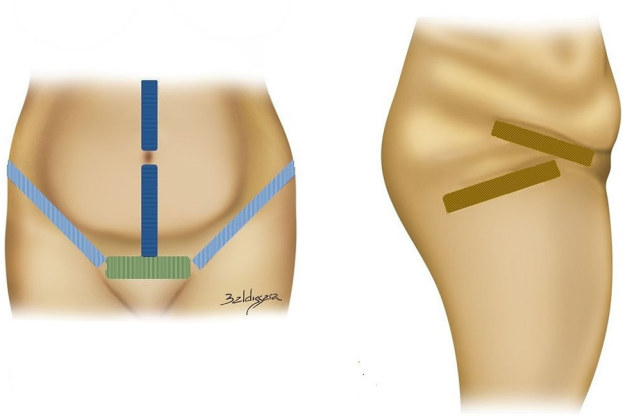

Fig. 2 Strong adherence zones of the subcutaneous tissue to the abdominal aponeuroses must be preserved, respecting its anatomical integrity

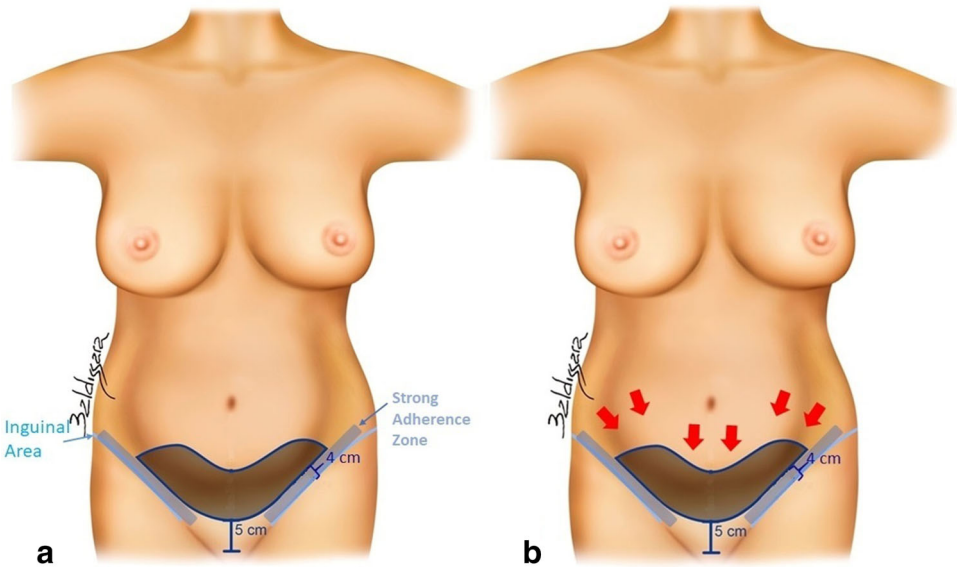

Fig. 1 **a** The marking of the flap to be resected should be reduced in the central portion and higher in the lateral portions, and this is a pattern that defines the final positioning of the abdominal scar, respecting the height and position of the umbilical scar and defining the resection pattern of mid-abdominoplasty with liposuction. **b** Rotation of the flanks lumbar flaps and partial infraumbilical flap to a medial inferior direction to achieve a transverse scar with medial concavity

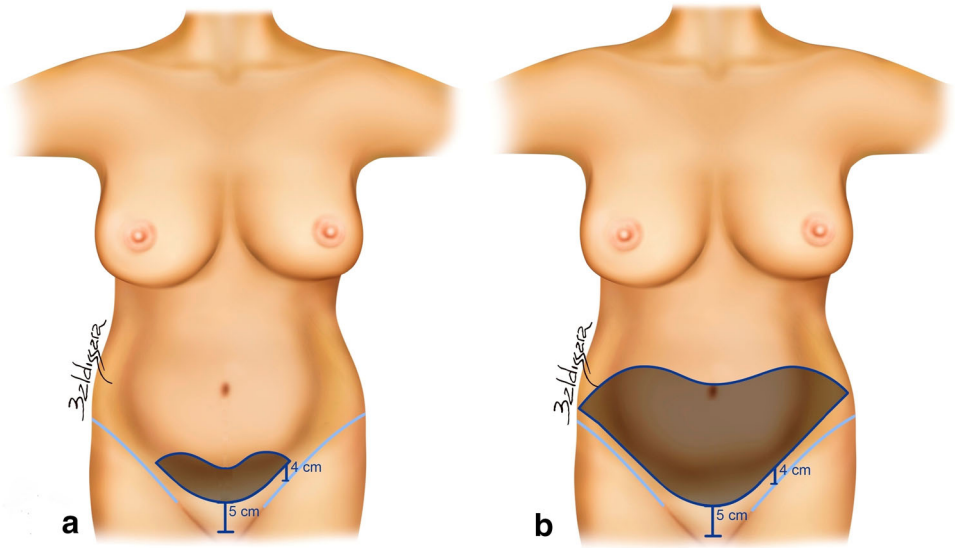

Fig. 3 **a** This mid-abdominoplasty pattern resection was transferred to smaller resections such as mini-abdominoplasty. **b** Larger resections such as "Complete Abdominoplasty" according to the possibilities and requirements of each patient

more and the curvature is flattened allowing more volume to be included in the laterals, the design format is maintained, and the resection can reach the umbilicus (Fig. 3b).

We treat the lipodystrophy by liposuction of the flank and upper abdomen before the dermolipectomy for better silhouette contour. We do continue the plication of the rectus abdominis with U-points using Prolene 0. And so, the umbilicus is fixed to the aponeurosis according to the Avelar technique [13]. This position is set at 14–16 cm of the pubis according to the modified Avelar technique [6]. After that, the flap is fixed to the aponeurosis with the Pollock–Baroudi points and closed in three anatomical planes [14].

Antibiotic prophylaxis is performed with 1 g of ciprofloxacin per day, for 7 days, and abdominal drainage by incision in the pubis for 5–7 days. The dressing consists of elastic bandages for 24 h with padded gauzes. A body garment is used from the first postoperative day and maintained for 15 days. Compressive stockings are also used from pre-surgery and maintained for 7 days and massage with a trained professional, from the second week after surgery.

Results

During our observation, we treated 136 patients of which the mean BMI was 28.58, the average age was between 41 and 50 years (38%), 134 (98.6%) were female and 2 (1.47%) were male.

One hundred and twenty (88.24%) patients were treated with mid-abdominoplasty. At the beginning, we indicated mid-abdominoplasty in those patients with flaccidity and significant lipodystrophy of the supraumbilical abdomen obtaining good results (Figs. 4 and 5). Subsequently, we extended the indication to cases of "pendulum" or "apron" abdomen that presented flaccidity and diastasis of the rectus abdominis as a result of loss of body contour, and the results were satisfactory (Figs. 6 and 7). Therefore, we consider that the parameters of the mid-abdominoplasty are applicable to most cases.

We also observed that the number of complications was low and within what was expected for any abdominoplasty procedure. There was a 5% rate of small seromas that were resolved with drains in 2–3 sessions, dehiscence in 1 case (0.74%) of 3 cm which resolved with resuture and one case (0.74%) of necrosis of 2 × 1.5 cm which solved with serial dressings (Table 3).

Discussion

Since the beginning of modern abdominoplasty in 1960, new modifications were generated by several authors [3, 4, 15–17]. However, the surgical stigmas of this treatment remained constant, such as high and straight scars.

There must be a change in the approach to the treatment of abdominoplasties. We place importance on the final position of the scar more than the amount of skin that is going to be removed. Because of this, we seek to leave the scar low and thus not affect the esthetics of the abdomen.

To maintain the scar in this position and to have a medial concavity, the resection cannot be of the entire infraumbilical block. If we analyze classical resection, the medial limitation of tissue produces a reduction in the distance between the umbilicus and the final scar, which generates a raised scar of rectilinear appearance.

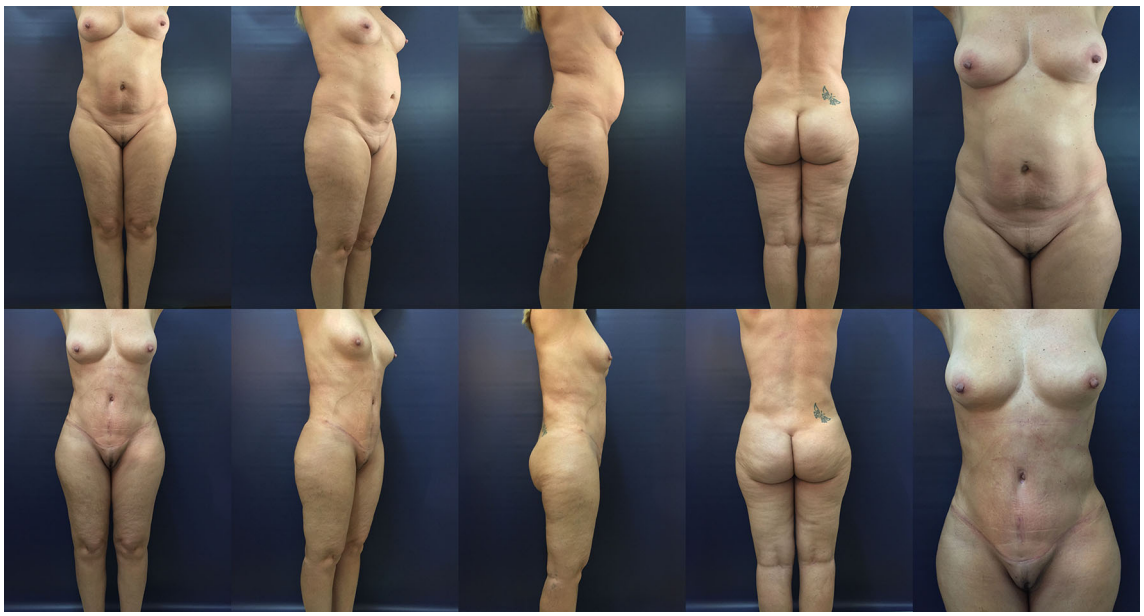

Fig. 4 A 52-year-old patient who underwent liposuction and mid-abdominoplasty. Pre- and postoperative of 2 months

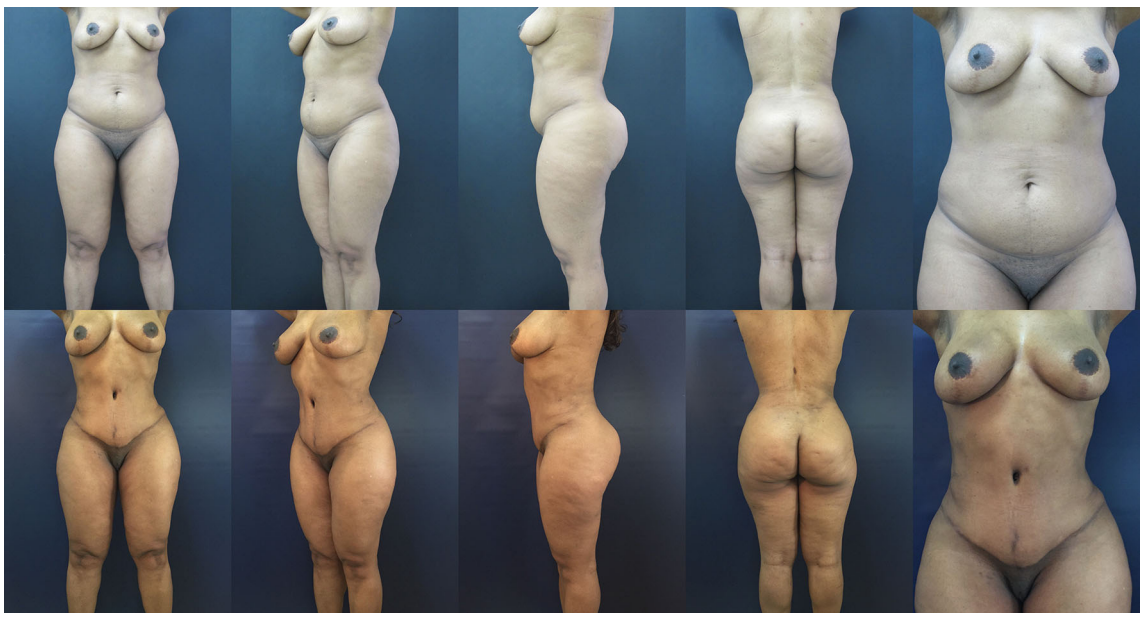

Fig. 5 A 45-year-old patient who underwent liposuction and mid-abdominoplasty. Pre- and postoperative of 4 months

We also propose that the lateral extremities of the marking are high, thus allowing a rotation of the flank lumbar flaps in a medial inferior direction. The objective is to achieve a transverse scar with a strong medial concavity and the extremities maintaining the lateral limits that follow the transversal fold of the abdomen. This location allows placing the scar in an anatomical position parallel to Langer's lines decreasing the tension and favoring wound healing (Fig. 8).

Moreover, weight gain in the abdominal region starts by accumulating in the flanks and sometimes exceeding to the hypogastrium, which leads to greater resection of the lateral segments and abstaining from great resection of the central region, even in patients with a large pubis. The result is an anatomically positioned final scar, giving the shape of a long and well-defined abdomen.

Initially, partial or subtotal resection of the medial infraumbilical segment was indicated to treat only those

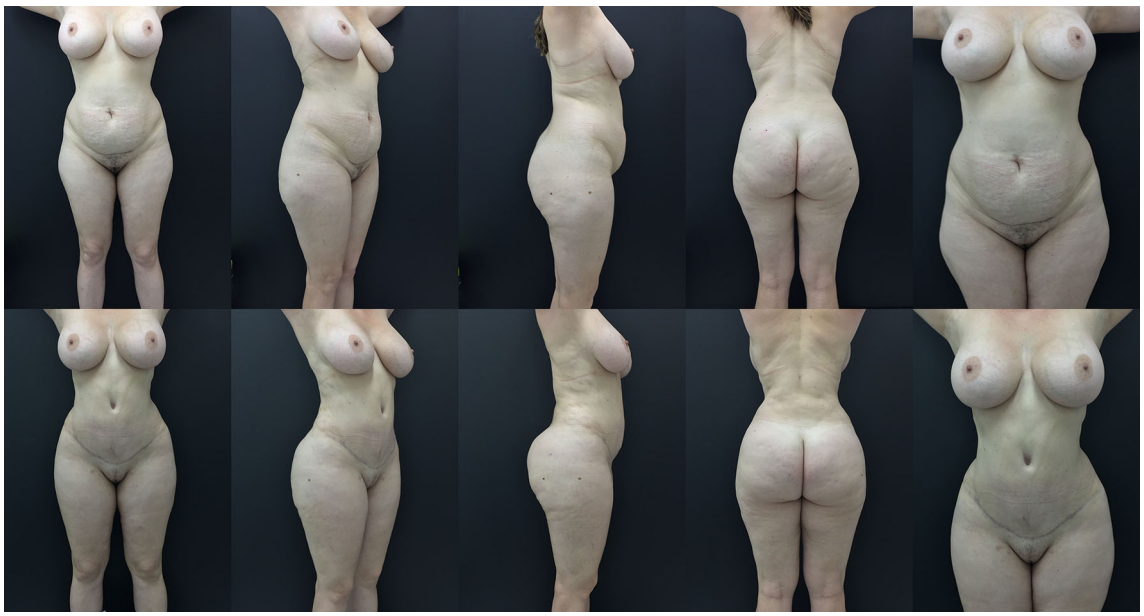

Fig. 6 A 34-year-old patient who underwent liposuction and mid-abdominoplasty. Pre- and postoperative of 3 months

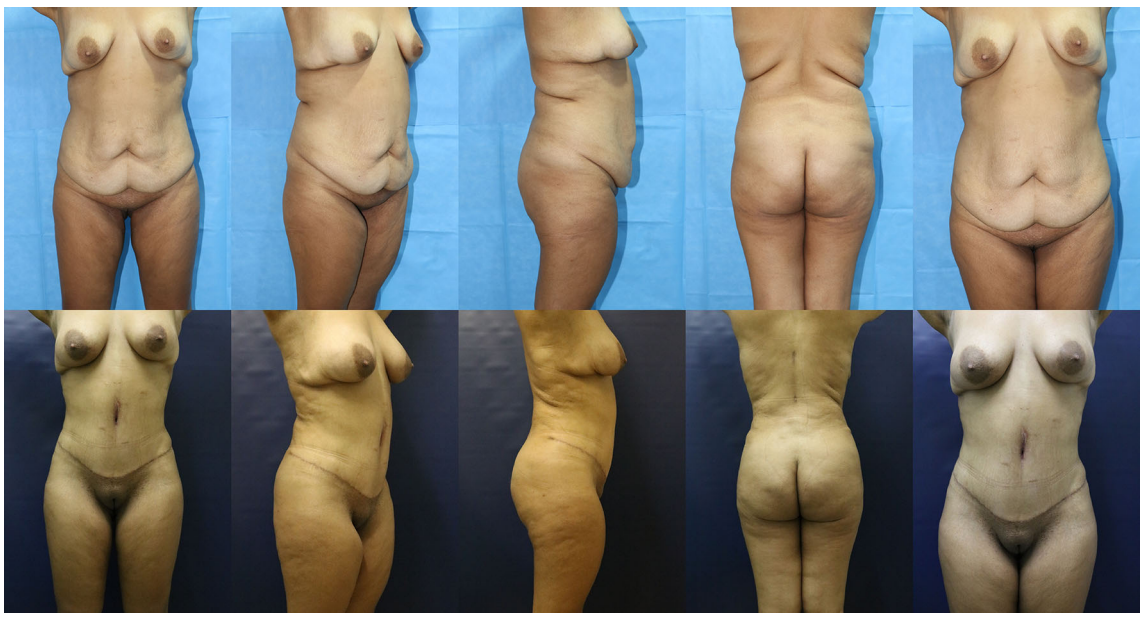

Fig. 7 A 23-year-old patient who underwent liposuction and mid-abdominoplasty. Pre- and postoperative of 4 months

Table 3 Complications

Complications	Patients	Percentage
Seroma	8	5.88
Necrosis	1	0.74
Dehiscence	1	0.74
Hypertrophic scar	0	0.00
Without complications	126	92.65
Total complications	10	7.35

cases that presented a small amount of central flaccidity of the supraumbilical skin of the abdomen. Afterward, we realized that our approach has highlighted a key aspect where the indication of mid-abdominoplasty primary is appropriate even in patients with massive weight loss and large abdominal flaccidity.

We also consider that the evaluation of the abdomen should differentiate the skin contractibility response to liposuction of the supraumbilical and infraumbilical regions since the quality and their behavior are different.

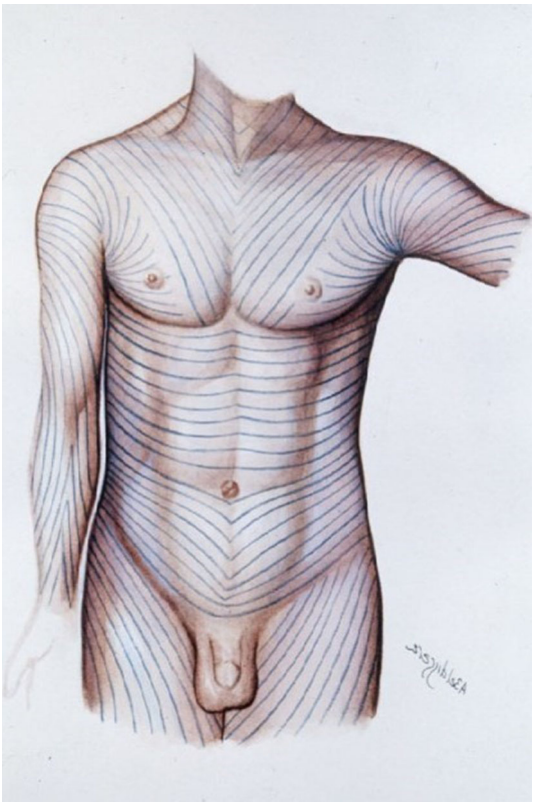

Fig. 8 We follow the parallel Langer's lines to achieve an anatomical and esthetic final scar position

We evaluate in these regions whether there is a predominance of lipodystrophy under the flaccidity of the skin. In cases where there is marked infraumbilical lipodystrophy, the treatment we indicate is liposuction since there is a good response generating infraumbilical skin contraction. On the other hand, in cases of supraumbilical lipodystrophy where the skin contractibility response is poor, we cannot indicate only a liposuction because there is a risk of adding major skin flaccidity in this region. We used a classification of abdominal deformities and their treatment as an attempt to standardize these treatments according to the degree of deformity, the elements present and the possible strategies (Table 2).

Another point to take into account is the umbilicus, which contributes greatly in the abdominal esthetics and the perception of a long abdomen.

The appearance of the three-dimensional umbilicus is influenced by the abdominal incision height, width, shape, umbilical pedicle length, disk diameter, umbilical shape and periumbilical fat distribution. The umbilicus may be found in several forms: wide, narrow, innie, shallow, herniated, virgin, already operated and absent [13, 18]. The treatment will depend on the type found and the technique chosen for this purpose.

Currently, there are many proposals to position the umbilicus, and all of them are valid as long as there is harmony. This is achieved through the height of the umbilicus in relation to the transverse scar of the abdominoplasty. That is why in our treatments, we seek to place the umbilicus at an average height of 14–16 cm as long as the original position allows it and according to the patient's biotype [19–22].

Regarding repositioning, we must observe the convergence of the lanugo that indicates the midline and elevates the area of the new umbilicus. It will be inserted 1–2 cm above the projection of the umbilical stalk on the skin, with sutures at 3–9 h to improve tension of the skin in the epigastrium.

It is important to remember that location changes with gender, since the male umbilicus is commonly lower down the abdominal wall than the female.

The ideal repositioning of the umbilicus should be done taking into account the perfusion to minimize the risk of postoperative necrosis and visible scars.

In the abdominoplasty procedure, the infraumbilical skin is usually resected, being cut the medial line of perforator vessels [21]. According to Huger's zones, only zone III of the lateral perforators is preserved. A study by Munhoz et al. proved that 80% of perforating, lymphatic vessels and nerves could be preserved by limited dissection. Perforators of the deep superior epigastric artery are more predictable [21, 22].

Another important point is to associate liposuction with mid-abdominoplasty because it acts not only in the border areas of the flap resection, making it possible to reduce the size of scars, improving the silhouette line and the body contouring. Also, liposuction of the flanks associated with abdominoplasty releases the lateral flap in the anterior and medial direction, producing a greater lateral rotation.

Liposuction and fat grafting complement the range of procedures. We used liposuction to accentuate the line alba and Spiegel [22]. We take special care to perform the definition just above the new umbilicus position toward the xiphoid appendix and preserve the lower portion. The association of high-definition lipoaspiration with abdominoplasty is performed in specific cases for which we think the result will be improved and will not affect the viability of the abdominal flap.

Conclusions

To obtain a more harmonious result, it is necessary to improve the position of the transverse scar, as well as to adequately place the elements: umbilicus, pubis and lateral extremities of the transverse abdominal scar. An adequate analysis and classification of abdominal deformities are required to establish appropriate strategies for the treatment of each case.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest to disclose. The authors Alberto Caldeira, Kelly Carrión and John Jaulis did not receive financial support for research, authorship and publication of this article.

Ethical Approval All procedures performed during this study involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent For this type of study, formal consent is not required.

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