Chapter 19
Plication of the Abdominal Wall in Lipoabdominoplasty

João Erfon and Claudio Maurício

Introduction

According to Sinder, the first publication on abdominoplasty was made by Demars and Marx in 1960 [35, 40]. Since then, the advance of scientific knowledge allowed the development and improvement of the surgical technique.

Currently, abdominoplasty is one of the most frequent cosmetic surgeries performed in the world [7, 14, 17]. Some factors such as security and lasting results have contributed to the evolution of this procedure. According to the American Society for Aesthetic Plastic Surgery's 2004 Cosmetic Surgery National Data Bank, the number of abdominoplasty increased by 344 % between 1997 and 2004 [20]. Several tactics and approaches were suggested and reproduced successfully by experts from around the world. One of the major contributions is credited to Avelar who opened a wide field performing important association of liposuction technique with abdominoplasty introducing new concepts which reduced the high incidence of complications during and after surgery [1]. In the beginning, he published mini-abdominoplasty combined with liposuction procedure, making this the full extent of the abdominal flap, without panniculus undermining [1]. Leão began plication of the aponeurosis above the navel on the preserved fascial and connective tissue [19]. Some years later, other authors following Avelar's surgical principles presented more contributions and even introduced the expression of "lipoabdominoplasty" to broaden the application of this

J. Erfon, MD (✉)
Director, Artclinic Ltda., Av Atilano de Moura, 530., Fortaleza, Ceará 60810180, Brazil
e-mail: erfon@artclinic.com.br

C. Maurício, MD
Preceptor of the Plastic Surgery Post-Graduate Course, Department of Surgery,
Walter Cantídio Hosp of the Federal University of Ceará, Costa Mendes, 1608-Third floor.,
Fortaleza, Ceará 33368061, Brazil
e-mail: claudiomauriciomr11@hotmail.com

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association to full abdominoplasty [34]. The main surgical principle is to preserve the fascia superficialis without exposure to abdominal aponeurosis. I introduced a systematization of lipoabdominoplasty with determination of three segments in the lower abdomen (Fig. 19.2a). In both lateral segments, the fascia superficialis and all the important anatomical structures would be maintained, while in the central one, below the navel, the fascia superficialis is resected, exposing the aponeurosis and allowing safe plication of the *rectus abdominalis* muscles [9, 10]. This subject is the main topic of this chapter since the perforator vessels are preserved during operation which provide normal blood supply to the remaining abdominal panniculus.

Technique

All patients with indication for abdominoplasty after careful clinical evaluation concerning the excess of the skin and accumulated adipose tissue provision are to be addressed, and hypotonia of the abdominal wall (Fig. 19.1) may be classified into three categories: (a) full abdominoplasty, (b) mid-abdominoplasty, and (c) mini-abdominoplasty [9, 10].

Full abdominoplasty – surgical demarcations are done with patient in standing position before going to the operating room. The areas of liposuction on the abdomen and flanks are marked as well as the incision lines. All surgeries are performed under general anesthesia. In the operating room with the patient in supine position, the incisions are marked again. They are positioned in order to keep the final scar at the hairline level following the abdominal groove laterally and the pubic region length do not exceed 6 cm (Fig. 19.1a). The navel is drawn as diamond-shaped incisions. Markings divide lower abdomen in three areas. Fascia superficialis must be resected at the central segment and maintained at the lateral ones (Fig. 19.2a, b).

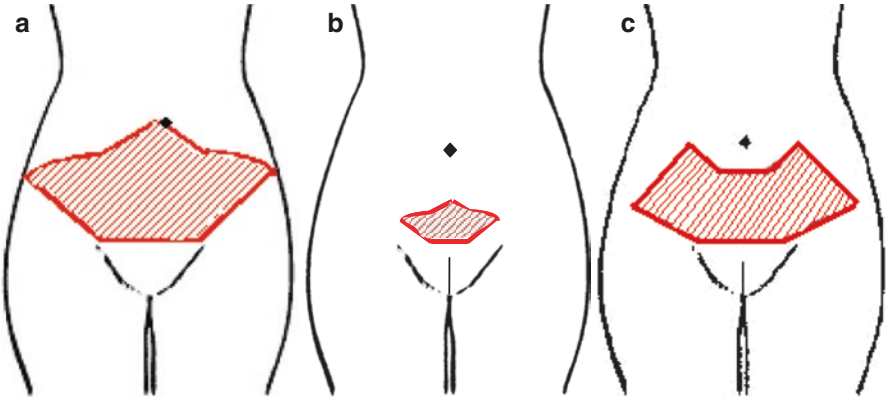

Fig. 19.1 (**a**) Surgical demarcations of full abdominoplasty. From the top point of the umbilicus, two slightly inclined lines are marked with the same dimension of the demarcation on the pubis. Another line is marked laterally to join the ends of the lower abdominal crease. (**b**) Planning of mini-abdominoplasty (planning of mini-abdominoplasty). (**c**) Mid-abdominoplasty planning (planning of mid-abdominoplasty)

All areas are infiltrated with saline solution (1000 ml) with epinephrine (1 ml). The operation starts with superficial and/or deep liposuction throughout the demarcation area (Fig. 19.3b). The incisions are initiated and the skin resected, preserving the fascia superficialis, on lateral sides of the lower abdomen, while in the central

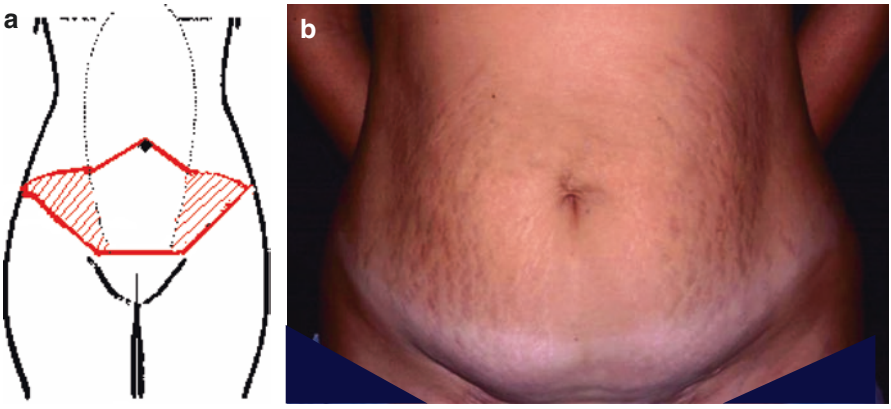

Fig. 19.2 (**a**) Drawing showing an area of infraumbilical conjunctive tissue as well as the tunnel having already been demarcated for plication of the abdominal muscle fascia. (**b**) Surgical planning and demarcation on a female patient. Two areas for liposuction (L) laterally; liposuction and panniculus undermining on midline above the umbilicus (L-U); two areas laterally of liposuction and skin resection (L-R); skin and subcutaneous resection on midline below the umbilicus (RSS)

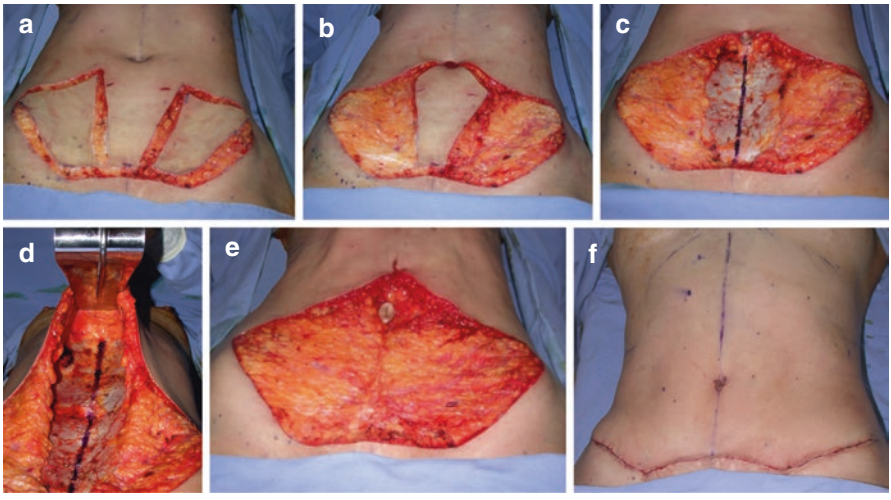

Fig. 19.3 (**a**) Beginning of the surgery with liposuction of the previously illustrated marked areas and incision of the lateral inferior cutaneous flaps of the abdomen. (**b**) Excision of the entire skin of the lower side-cutaneous flaps, leaving intact the superficial fascia. (**c**) Resection of the medial infraumbilical area with the muscle fascia being exposed, preserving the superficial fascia side. (**d**) Undermining of the tunnel is plication from the umbilicus up to the xiphoid. (**e**) Occlusion of the superficial fascia plication keeping the whole lymphatic system and vascularization. (**f**) Final result leaving a nice body contour

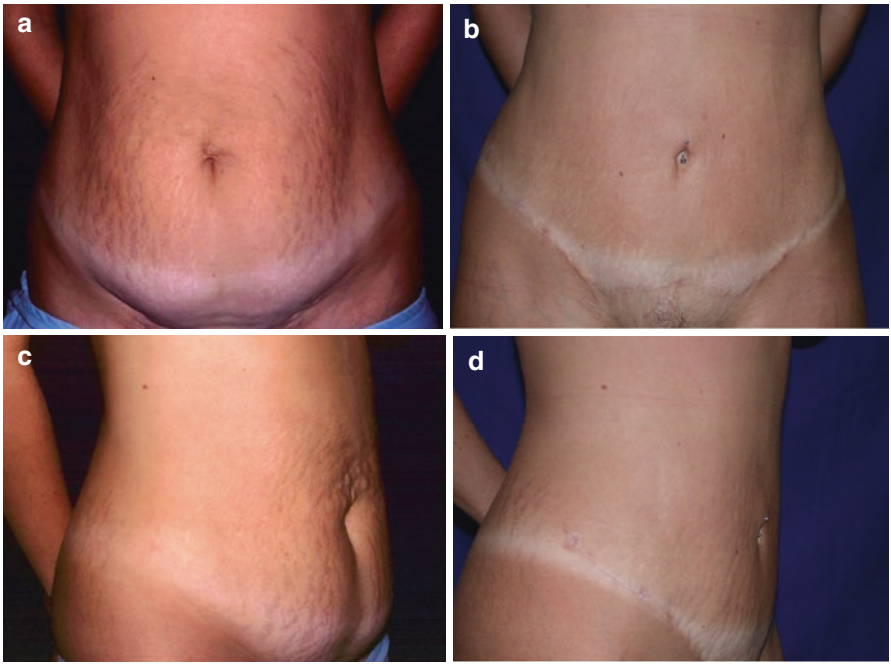

Fig. 19.4 (**a**, **c**) Preoperative full lipoabdominoplasty. (**b**, **d**) Postoperative 6 months

area, excision of tissue is made to muscle aponeurosis (Fig. 19.3c). The navel is incised all around, and a tunnel is undermined on the central area in the upper abdomen, limited to the muscle of the rectus, taking care to preserve the perforating vessels (Fig. 19.3d), as described by Avelar [1] initially and later by Saldanha [34] and other authors [10, 11, 34].

The plication of the *rectus abdominalis* muscles is performed with double isolated stitches in "X" on the midline of the abdomen from the xiphoid process to the pubis, using mononylon 0 (zero) for correcting muscle diastasis. The fascia superficialis on infraumbilical area is also plicated with colorless mononylon 3-0 (Fig. 19.3e) [10, 11, 25]. The association of infraumbilical muscular plication and approximation of the lateral segment of the Scarpa's fascia allow mobilization of the peripheral tissue, providing improvement of body contouring with higher-definition waist and reducing the extent of the lower abdominal scar, as well as eliminating the "dead space" (Fig. 19.3f).

Afterward, the operating table is bent and the patient is flexed; the upper abdominal skin flap is pulled downward, and the suture starts with mononylon 2-0, using five internal points, separated, to suture it to the pubis. The suture is completed by internal separated stitches subcutaneously, using colorless mononylon 3-0. External sutures are not used (Fig. 19.4). The umbilicus is reestablished with internal points separated with colorless mononylon 4-0 being the vertical dimension longer than the transversal one [3]. Complementary liposuction may be carried out during this surgical procedure.

This technique has also been used in cases of mini-abdominoplasty (Fig. 19.5) and mid-abdominoplasty (Fig. 19.6).

Simple dressing with gauze and elastic garment is applied. The use of pneumatic compression device on the lower extremities is used from the beginning of surgery until lasting while the patient is in the hospital. Also the use of elastic socks during the 21 days postoperatively. According to the clinical indication following the risk assessment protocol for thrombotic events, Caprini [41] prescribed low molecular

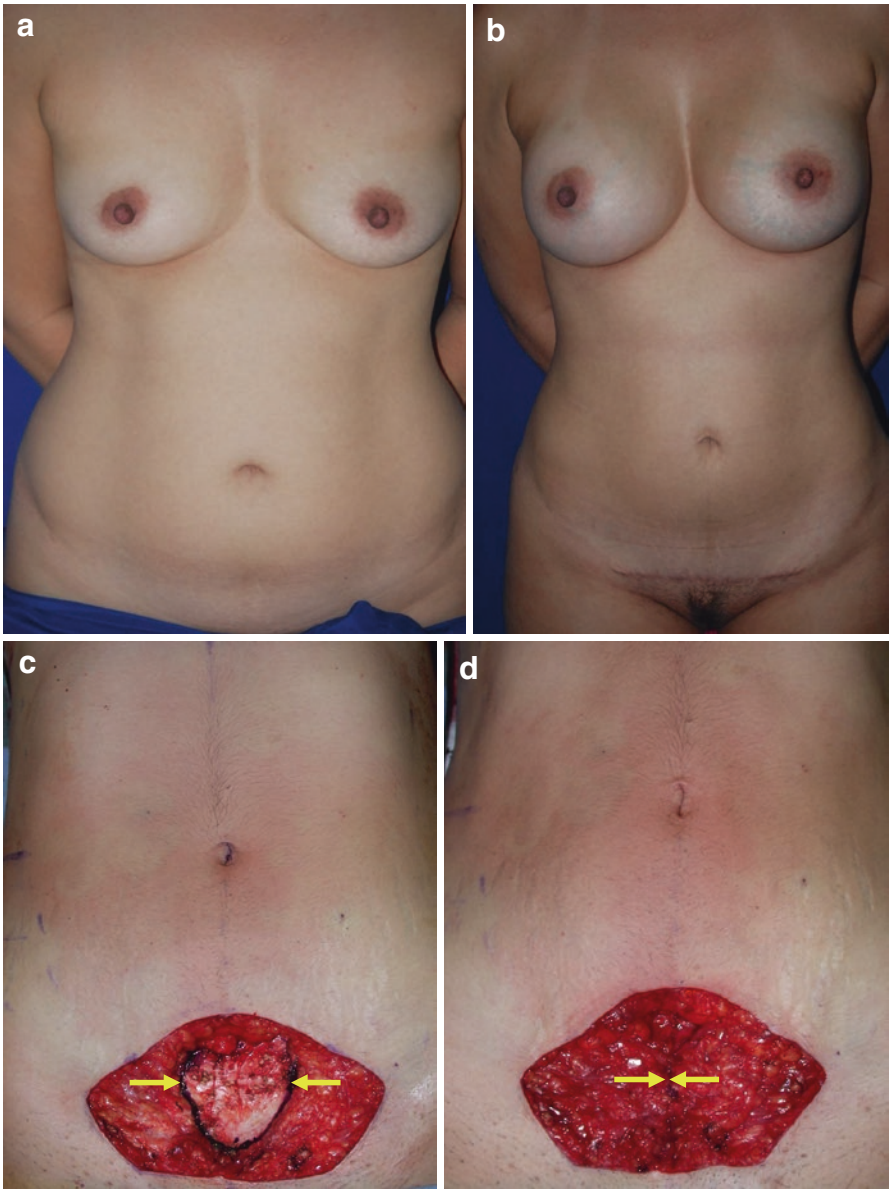

Fig. 19.5 (**a**, **c**, **d**, **e**) Pre- and trans-operative lipominiabdominoplasty. (**b**, **f**) Postoperative 6 months

Fig. 19.5 (continued)

weight heparin, 40 mg/day, for ten days [4, 21, 22, 30]. Patient can go home on the next day and may walk carefully.

Complications

Many authors describe care to reduce complications in abdominoplasty: Uebel [39] with the recommendation of smaller detachment [39], Baroudi and Ferreira with the membership points to reduce seroma [5] Avelar [1], Saldanha [34], and Erfon [9] with lipoabdominoplasty able to significantly reduce both complications which was more common in abdominoplasty, skin necrosis and seroma [1, 9, 11, 34]. Fatos have been proven with studies by Graf et al. [13] and other authors [1, 2, 10, 11, 13, 21, 34]. Hurvitz et al. point out the infection as the second major complication in abdominoplasty and recommend the use of antibiotics while keeping the drain [14] in lipoabdominoplasty. As far as the operation is performed without panniculus undermining, I do not use any kind of drain [11]. The use of antibiotics is used for seven days postoperatively.

Comparing the observed data using the traditional technique [6] with the data published by Matarasso et al. [20], the number of complications proved to be extremely low using the lipoabdominoplasty [6, 20]. During 14 years, one single case of epidermolysis at the distal end of the flap (in mid-abdominoplasty) and one case of hematoma that was resolved with drainage and required secondary liposuction after 6 months are recorded. The two most common complications that were

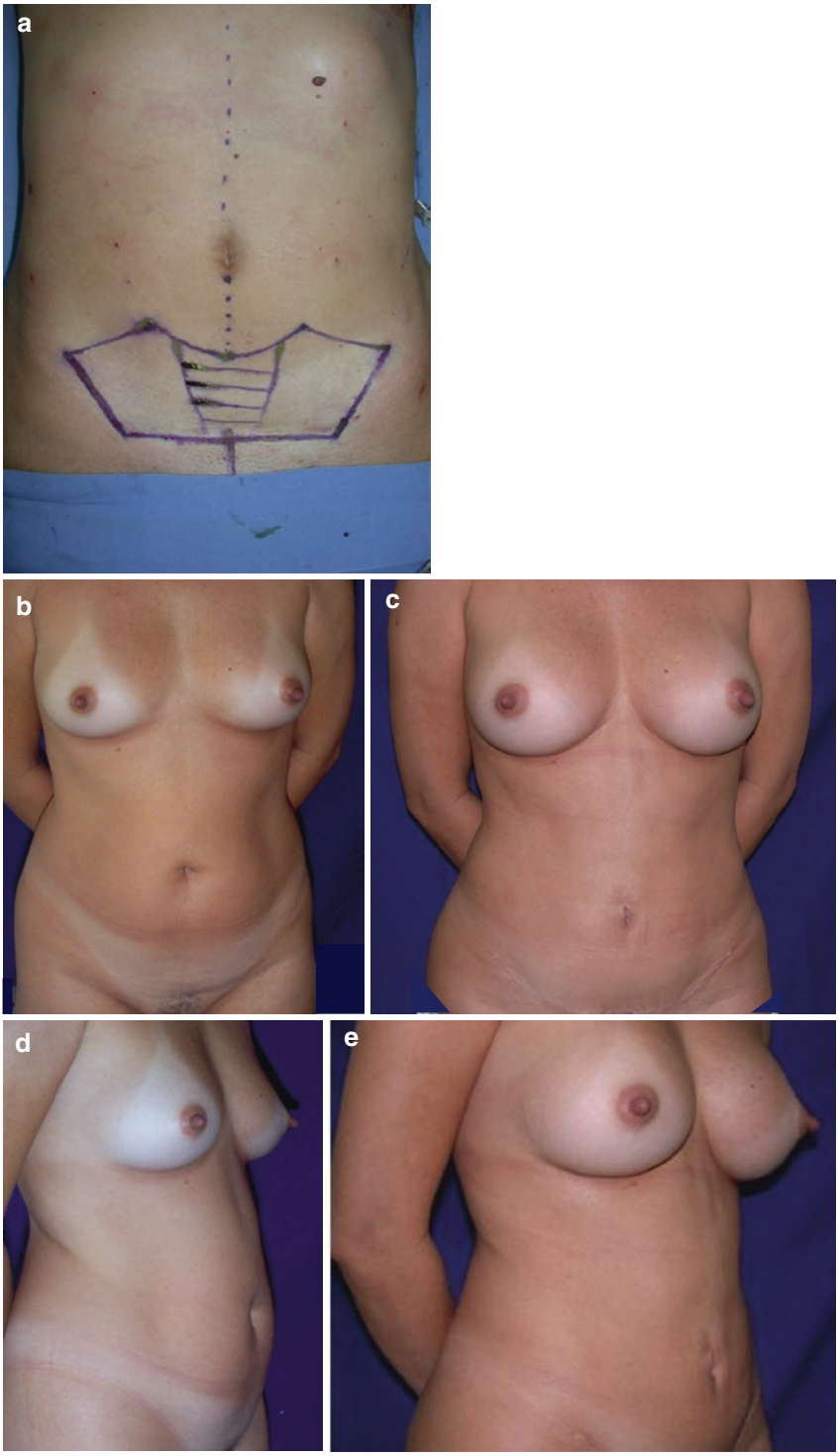

Fig. 19.6 (**a**, **b**, **d**) Planning preoperative lipomidabdominoplasty. (**c**) Postoperative 6 months

the seroma and secondary re-interventions occurring in 80% of cases, using the traditional technique, coinciding with other authors [2, 5, 14], were significantly reduced. The re-interventions used to be are of 4% after traditional abdominoplasty. In the use of lipoabdominoplasty, seroma is clinically insignificant at 0% (zero percent).

The literature describes other complications with the use of traditional abdominoplasty [14].

Discussion

At the end of the twentieth century, Avelar [1] presented new surgical concepts for abdominoplasty which are highlights of the remarkable Kelly's [42] publication that described the basic fundaments on "resection of the abdominal panniculus." Great improvement of the traditional abdominoplasty technique was introduced by Callia [6] through wide undermining of the abdominal flap. Later, Illouz [15] with his wonderful liposuction technique made an important contribution to the aesthetic treatment of body contour and also to the abdominal wall. Nevertheless, abdominoplasty has undergone a deep change with the advent of combination of traditional abdominoplasty with liposuction with limited panniculus undermining proposed by Avelar [1]. Following Avelar's concepts, Leão [19] performed reinforcement of the aponeurosis above the umbilicus, Erfon [9] presented plication of the abdominal aponeurotic wall below the umbilicus, and later Saldanha et al. [34] suggested the term lipoabdominoplasty.

The use of liposuction of the abdominal wall associated with mini-abdominoplasty and also a combination of mini-abdominoplasty with skin resection on submammary folds, without panniculus undermining and preservation of perforating vessels, was described by Avelar [1]. Later, the association of liposuction to full abdominoplasty was proposed by Saldanha et al. [34]. Therefore, the fundamental principles of modern abdominoplasty were introduced with minimum detachment of the abdominal skin flap, plication of the *rectus abdominalis* muscles, and preservation of fascia superficialis. These concepts brought great progress in the quality of results of abdominoplasty without damage to the blood supply of skin flaps and/or increase in the rate of complications described by Roostaeian et al. [33]. The mark of three segments in the lower abdomen, preserving the fascia superficialis on both sides and resecting the central segment, below the navel, exposing the muscle aponeurosis, enabling a safe plication under direct vision, and keeping the principles of those two authors, was introduced by Erfon [9] as a named set contribution. This new technique requires a short learning curve and allows the association of abdominoplasty and liposuction setting exceptional aesthetic results, more secure vascularization of the abdominal panniculus, as well as a drastic reduction of complications such as seroma and necrosis.

The Scarpa's fascia preservation became an effective mechanism for reducing the seroma rate and reduces the throughput early drain when applied as was mentioned by Costa Ferreira et al. [8].

According to Sinder [35], plication of the muscle diastasis is done since 1960, with suture of the anterior aponeurosis of the *rectus abdominalis* muscles as the most common procedure.

Different methods have been used in the abdominal wall plication [19, 23, 27, 39]; however, plication of the rectus abdominis muscles, as recommended by Pitanguy [31], has been routinely used by most authors.

For proper plication of the abdominal wall, some factors are important: (a) Knowledge of the anatomy. (b) Ultrasound of the abdominal wall must be a routine preoperatively and also Doppler echocardiography for evaluation of diastases of the rectus muscles and hernia, as well as the lower limbs in patients with high-risk factors for deep vascular thrombosis (DVT). (c) Body mass index less than 30. (d) Dissection of the tunnel for plication, for the pubis, up to 1 cm above the xiphoid process, keeping the musculocutaneous perforating vessels. Even the upper skin flap and the superficial fascia in the lower abdomen, the inferior epigastric vessels and superficial iliac circumflexes, lymph vessels, and nerves of the region must be preserved [11]. (e) "X" suture stitches separated using mononylon 0 (zero). (f) Eliminating the break of the aponeurosis at 0.5 cm intervals, 1 cm above the xiphoid process to the pubis, with maximum detachment up to 2 cm lateral to medial edges of the *rectus abdominalis* muscles.

It is essential to keep viable the musculocutaneous perforating vessels on the superior abdominal panniculus flap for adequate blood supply as well as the fascia superficialis in the lower abdomen (Fig. 19.3d), after plication of the aponeurosis.

Superficial fascia plication is carried out to avoid dead space formation and seroma (Fig. 19.3e), and reduces the extension of the final scar of abdominoplasty [9, 10]. Excellent aesthetic results may be achieved by reducing lower abdomen connective tissue amount (Fig. 19.4). It is not necessary to use drains after abdominoplasty as mentioned by Avelar [1] and Erfon [9]. Anatomical studies prove that maintaining the superficial fascia actually prevents seroma as reported by Koller and Hintringer [18] and Nahas [28].

Factors such as preoperative extent of diastasis of the *rectus abdominalis* or previous abdominal surgery do not seem to compromise the longevity of the correction plication [37].

The diastasis of the upright of recurrences is related to quality plication showing no relationship with the postoperative time [28].

The vertical suture is more resistant than the horizontal by virtue of the distribution and arrangement of muscle fibers [16].

Although there are standard techniques for the treatment of the navel Avelar [43], the lozenge umbilicoplasty [9] shows greater vertical extension than the horizontal and has been used with satisfactory results (Fig. 19.2). It should not be fixed to the deep aponeurosis, keeping at least 1 cm pedicle to avoid tension avoiding necrosis and ungraceful scars.

In patients with large diastases diagnosed preoperatively, the use of elastic straps is started one month before surgery, to avoid postoperative respiratory complications.

The term mid-abdominoplasty was used by Stuckey [36] to describe a surgery with transverse incision, involving the umbilical region. However, it has been used by Erfon [9] to describe his classification for abdominoplasty, in special cases where the incisions of the mini-abdominoplasty need to go beyond the pubis, with purpose of larger skin resection, and it is impossible on full abdominoplasty. He also recommends partial transverse pubectomy in order to keep the size of the pubis at most 6 cm [9].

Recently, Rodrigues studying the intra-abdominal pressure found that the increase in this pressure, resulting from muscle plications, was not significant and returns to the preoperative level in 15 days [32],

In healthy patients, plication may even improve lung function by the ability to optimize the forced vital capacity [38].

Beyond the plication of the aponeurosis, perform plication of the superficial fascia, excluding the "dead space" (Fig. 19.3e).

Nahas [24] ranked abdominoplasty according to aponeurosis deformity of the abdominal wall. Also, he demonstrated that the plication improves the definition of the waist [23] maintaining in the long term: whether used absorbable or nonabsorbable [28] or even post-pregnancy tummy tuck [26]. The same author also points out that the abdominal wall may be weakened by previous surgery, pregnancy, weight change, age, and congenital disorders and, in the latter case as well as in cases of recurrence of the plication, would require plication of the posterior sheath of the *rectus abdominalis* muscles [27, 28].

The plication of the anterior aponeurosis of the *rectus abdominalis* muscles, even in cases of recurrence, has been routinely used to separate points, reversed "X," with double mononylon 0 (zero), with good distribution of voltage.

Some authors have proposed plication through videolaparoscopy procedure [2, 12, 29].

Murphy et al. [21] noted that the results found in studies about the chemoprophylaxis of postoperative deep vein thrombosis in patients undergoing orthopedic or abdominal surgery intracavitary could be extended to larger plastic surgeries such as abdominoplasty, because of anatomical areas, degree of invasion, and population profile [21].

Although there is no consensus in the literature as the absolute indication for prophylaxis of deep vein thrombosis in patients undergoing abdominoplasty, the use of enoxaparin 20–60 mg/day for a period of 1–4 weeks based on the risk assessment protocol Caprini [41] was effective in reducing thrombotic events [21, 22].

The use of the Caprini model (2010) also showed effective in reducing these events in patients undergoing plastic surgery [4, 30].

Conclusions

The plication of the abdominal aponeurosis in abdominoplasty is one of the most important aspects of this surgery. It has been indicated in more than 90 % of our patients with better aesthetic and functional results. We have observed long term

excellent outcomes, even in adverse situations such as changes of weight and pregnancy and present recurrence in rare cases. The possibility of associating the lipoabdominoplasty [1, 2, 11, 34] with a safe plication and minimal undermining allows: a) preservation of noble anatomical structures; b) minimal dead space; c) better accommodation of lower abdominal preserved tissue; d) low seroma levels; e) reduction of re-interventions necessity. As observed above all these findings are undoubtedly importants contributions of the final process of this technique [10, 11].

The classification of patients in three surgical groups – full abdominoplasty, mini-abdominoplasty, and mid-abdominoplasty – facilitates surgical indications, especially for beginners, using this technique.

The different marking – with the predetermination of three segments in the lower abdomen, preserving the superficial fascia on both sides and resecting the central block to the muscular aponeurosis, reducing the learning curve, and optimizing the development of lipoabdominoplasty – has also been an important facilitator in the use of this surgical technique.

Another important contribution is the partial transverse pubectomy to avoid high and unsightly scars, keeping the pubis of adequate size, around 6 cm.

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