Vaser-Assisted Breast Reduction

28

Alberto Di Giuseppe

Abstract

Ultrasound energy is being applied to the breast tissue to achieve breast reduction and correction of mild- to medium-degree breast ptosis. The ideal candidate for a breast reduction with ultrasound-assisted lipoplasty is a patient with juvenile breasts that are usually characterized by fatty parenchyma or a patient with postmenopausal involution parenchyma, with good skin tone and elasticity present. The author describes the technique of Vaser-assisted breast reduction in combination with the Passot method of breast reduction.

28.1 Introduction

Ultrasound energy has been applied to the adipose component of the breast parenchyma in case of breast hypertrophy to reduce the volume of the breast mold. As is known, ultrasound energy was initially used by Zocchi [1–6] to emulsify fat. A special instrument, composed of an ultrasound generator, a crystal piezoelectric transducer, and a titanium probe transmitter, was utilized to target adipocyte cell.

This new technology was first applied to body fat to emulsify only fat cells while sparing the other supporting vascular and connective components of the cutaneous vascular network. More recently, Goes [7], Zocchi [1–6], Benelli [8], and the author [9–12] have started to apply this technology to the breast tissue to achieve breast reduction and correction of mild- to medium-degree breast ptosis.

28.2 Preoperative Preparation

28.2.1 Patient Selection

The ideal candidate for a breast reduction with ultrasound-assisted lipoplasty (UAL) is a patient with juvenile breasts, which are usually characterized by fatty parenchyma, or a patient with postmenopausal involution parenchyma, with

A. Di Giuseppe, M.D.
Department of Plastic and Reconstructive Surgery, University of Ancona, Ancona, Italy
e-mail: alberto.digiuseppemd@gmail.com; adgplasticsurg@tin.it

M.A. Shiffman, A. Di Giuseppe (eds.), *Liposuction: Principles and Practice*,
DOI 10.1007/978-3-662-48903-1_28

good skin tone and elasticity present. Between 60 and 70 % of women with large breasts are candidates for reduction with UAL. Preoperative assessment includes a mammographic study, breast clinical history, evaluation of breast ptosis, and evaluation of the consistency of breast parenchyma.

28.2.2 Preoperative Mammography

Preoperative mammograms (anteroposterior and lateral views), the so-called the Eklund view, are taken to evaluate the nature and consistency of the breast tissue (fibrotic, mixed, or fatty parenchyma), the distribution of the fat, the presence of calcifications, and areas of dysplasia or nodularity that might necessitate further study or biopsy (Fig. 28.1). The presence of fibroadenomas, calcifications, and other suspected or doubtful radiologic findings should be double-checked with ultrasound and a radiologist experienced in breast tissue resonance.

28.3 Contraindications

Patients with a history of breast cancer or mastodynia and fearful of potential sequelae from this new technique were not considered for the author's study. Furthermore, because the amount of fat in the breast is variable as is its distribution, not all women are candidates for breast volume reduction with UAL. If fat tissue and glandular tissue are mixed, penetration of the tissue may be impossible, as noted by Lejour [13] and Lejour and Abboud [14]. If the breast tissue is primarily glandular, the technique is not indicated.

28.4 Preoperative Planning

The distance from infraclavicular notch and the nipple is drawn by hand (Fig. 28.2). Circles indicate the area of major volume to be addressed. A circle of about 5 cm diameter is marked around the nipple. This area is not addressed by ultrasound as it clearly contains 90 % of the breast

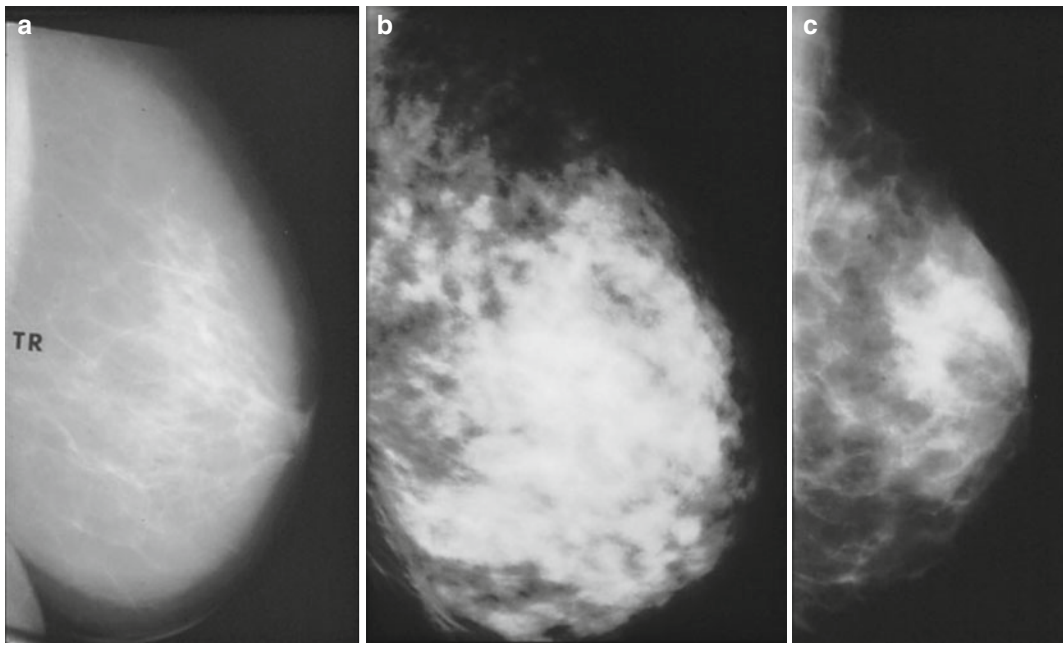

Fig. 28.1 Mammographic evaluation of candidates for breast reduction with the use of ultrasound-assisted lipoplasty (UAL). (**a**) A typical fatty breast. This patient is an ideal candidate for UAL. (**b**) Fibrotic glandular tissue is a contraindication for UAL. (**c**) Fibrotic mixed tissue. This patient is a candidate for UAL of the posterior upper and lower cone

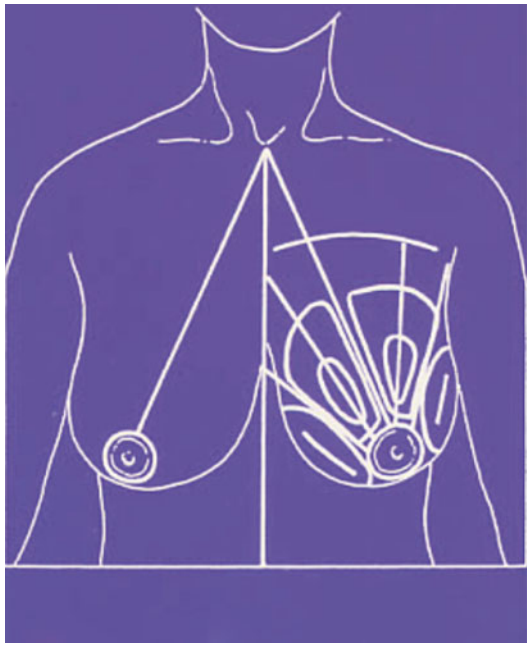

Fig. 28.2 Distance from infraclavicular notch and nipple: *circles* indicate the area of major volume to be addressed, and a *circle* of about 5 cm diameter is marked around the nipple

tissue. Ultrasound energy targets only the fatty tissue of the breast, sparing the parenchymal components.

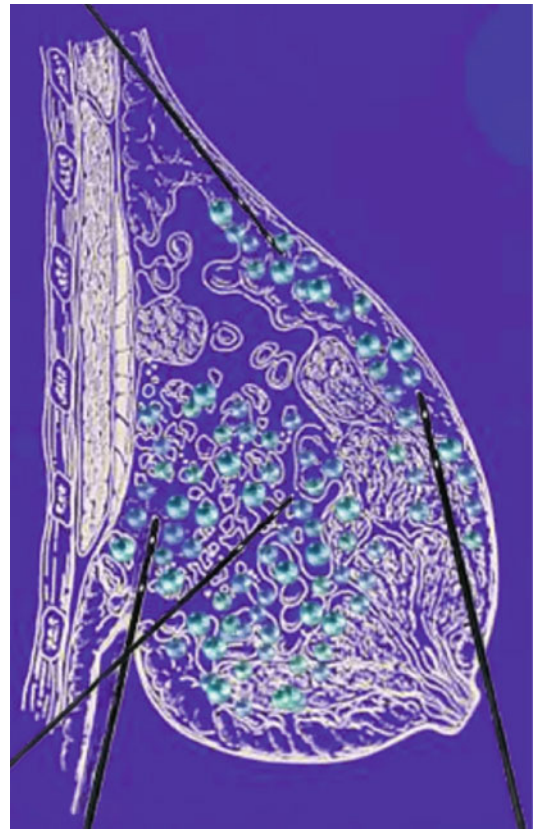

Fig. 28.3 The three different layers of infiltration (superwet infusion) of the breasts: deep, intermediate, and superficial (1.5:1/2:1 ratio)

28.5 Surgical Technique

28.5.1 Infiltration

Infiltration should be divided into the three different layers of the breast: deep, intermediate, and superficial (Fig. 28.3). In deeper layers and intermediate, I expect a 1.5:1 ratio between infiltration and aspirate; in the superficial layer, I normally infiltrate twice of what I expect to extract (2:1 ratio). Blunt infiltration cannulas are used as described by Klein, 15–20 cm long. A meticulous infiltration of the superficial layers is essential and then wait for 15 min minimum to allow adrenaline make its effect, before starting ultrasound. In a total of 500 mL of infiltration, normally 400 mL is for deeper and intermediate layers, 100 mL for superficial layers.

28.5.2 Skin Incisions

The operation begins with the introduction of the skin protector placed at the incision site, normally placed 1 cm below the inframammary crease (Fig. 28.4). This skin port is designed to protect against friction injuries of the solid titanium probe during its continuous movement.

The fatty breast is emulsified in the lateral and medial compartments, the upper quadrants, and the inferior aspect of the periareolar area. All the periareolar areas, where most of the glandular tissue is localized (5 cm circumference around the nipple-areola complex), are preserved. The deep portion, mostly fat, is also emulsified, allowing the breast mound to regain a natural shape through upward rotation thus

Fig 28.4 Skin ports

increasing the elevation from initial position, taken from the midclavicular notch. Up to 4 cm of breast elevation is obtained after proper reduction and stimulation to allow skin retraction and correction of the ptosis.

Two 15–2.0 cm stab incisions, one at the axillary line and the other 2 cm below the inframammary crease, are made to allow entrance of the titanium probe. A periareolar incision can be made in patients with very lax skin for further subcutaneous stimulation. Through these incisions the surgeon can reach all the breast tissues, working in a crisscross manner. The skin is protected from friction injuries with a specially made skin protector. Recently, the ultrasound device software has been upgraded to provide the same degree of cavitation with less power, which reduces the risk of friction injury and burn at the entrance site, which even allows discontinuing the use of the skin protector.

28.5.3 Probes

With the existing technology, a solid probe has been found to be more efficacious than a hollow probe for cavitation, which is the physics phenomenon that allows fat fragmentation and destruction. Moreover, the level of ultrasound energy, conveyed by a hollow probe, is limited, and consequently the level of the cavitations obtained in the tissue is diminished.

The Vaser system (Valeant Pharmaceuticals North America LLC, Bridgewater, NJ) provides different sizes and length of solid titanium probes, expressively designed to fulfill all purposes in body contouring, as well as in capability of emulsification through the cavitation effect produced by the ultrasound energy (Fig. 28.5). The piezoelectric transducer transforms electric energy into "vibration energy," thus allowing the solid titanium probe to emulsify the target fat cells. Four different probe diameters are actually provided by the manufacturers:

1. 2.2 mm diameter, for the face.
2. 2.9–3.7 mm diameter, for body contouring, including breasts.
3. 4.1 mm diameter, for larger areas and big volumes of fat.
4. 3.7 mm diameter probe with a special "cone tip" designed to emulsify male breasts but very aggressive also in fibrous tissue (Fig. 28.6). The efficacy of these probes, which are narrower than the previous technologies available on the market, is connected with their design, as they are provided with rings (one, two, or three) at the tip of each probe.

Rings have two special scopes:

1. To enhance the efficiency of the emulsification that is not limited to the tip but extended to the last 1.5 cm of shaft
2. To allow a larger selection of options, for targeting the various tissue types (purely fat, mixed, fibrotic), by utilizing different probes

The number of rings to be chosen depends on types of tissue encountered: the most fibrotic is

Fig. 28.5 The Vaser system (Valeant Pharmaceuticals North America LLC, Bridgewater, NJ)

treated with one ring, the less dense tissue (pure fat) with the three rings. These options are not purely an academic difference: the energy and the wavelength of each probe are selected for the target tissue, avoiding unnecessary extra power, thus energy which is useless and a potential cause of secondary unwanted complications (already seen with previous technologies).

In breast reduction with pure Vaser, the preferred probe is 2.9 mm, one ring, for deep layers, and the 3.7 mm, three rings for superficial layers (Fig. 28.7).

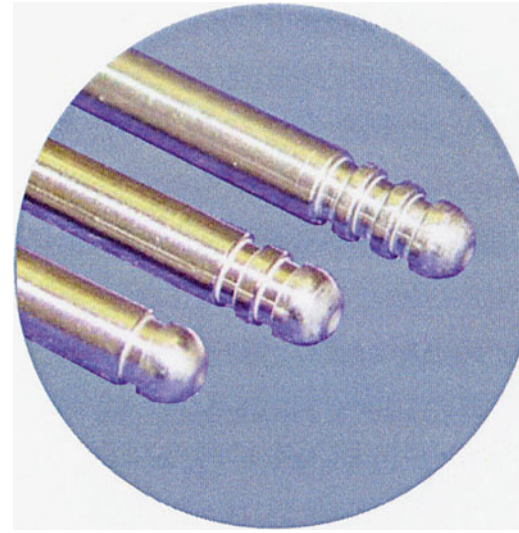

Fig. 28.6 Probes

Recently, the Vaser surgeon may utilize two further options:

1. The 4.5 mm large probe, for larger volumes, which has a higher percentage of fat emulsification for minute of time/depending on the diameter of the probe (Fig. 28.8)
2. The "cone" tip probe, which is very aggressive in fibrous tissue and has been designed for male breast (gynecomastia) for breast tissue destruction (Fig. 28.9)

Larger probes are recommended in all massive volume cases, including big breasts, and the cone tip in really fibrotic breast.

28.5.4 Technique

28.5.4.1 Fat Emulsification

In breast reduction with UAL, the duration of the procedure varies depending on the volume of reduction, the type of breast tissue encountered, and the amount of skin retraction required. A breast with purely fatty tissue is easier to treat than one with mixed glandular tissue, in which fat cells are smaller, stronger, and denser.

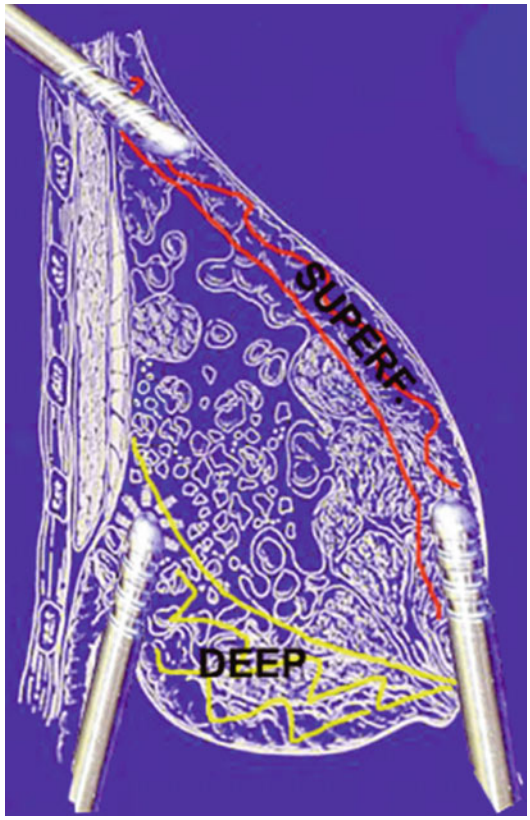

Fig. 28.7 Technique: 2.9 mm probe, one ring for deep layers; 3.7 mm probe, three rings for superficial probe emulsifying deep layers and undermining the superficial layers

Fig. 28.8 New probe

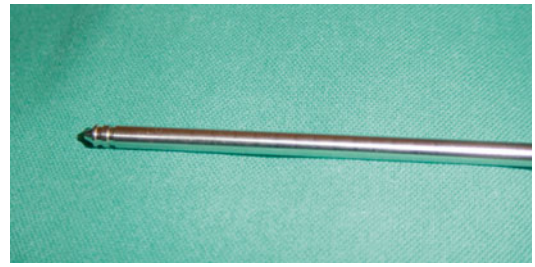

Fig. 28.9 One ring: 4.1 mm

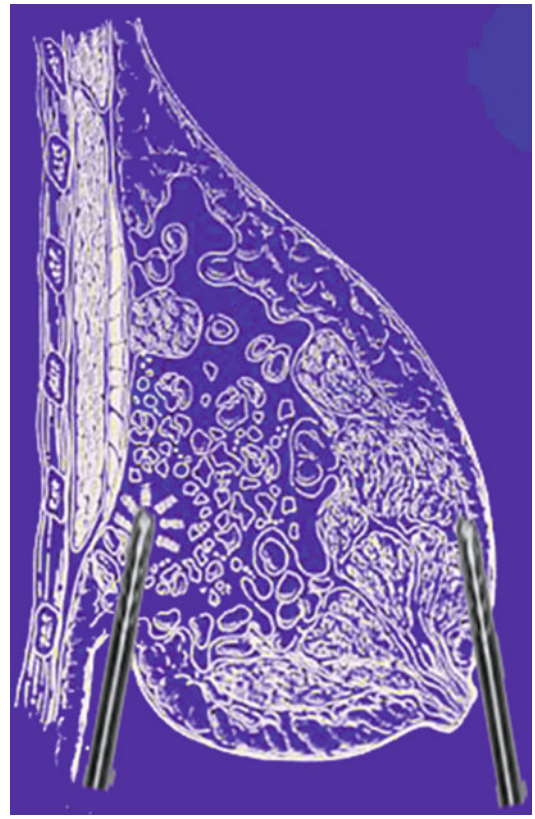

Fig. 28.10 Timing. Superficial layers: 2–3 min maximum. Deeper layers: 7–20 min depending on fat to emulsify

The author started utilizing the Vaser ultrasound device with solid probes (2.9–3.7 mm wide). It delivers 50 % of the ultrasound energy in comparison with the older sculpture unit (by SMEI, Casale Monferrato, Italy), which was used from 1990 to 2001, while emulsifying fatty tissue much more efficiently. The duration of the procedure and the amount of energy required to liquefy the excess fat may vary depending on the characteristics of the tissues encountered, the volume of the planned reduction, and the type of the breast tissue. Purely fatty breast tissue is easier to treat than mixed glandular tissue, in which fat cells are smaller, stronger, and denser. Treatment of the target tissues starts with 10–15 min of ultrasound energy in fat tissue, which usually produces between 250 and 300 mL of emulsion (Fig. 28.10).

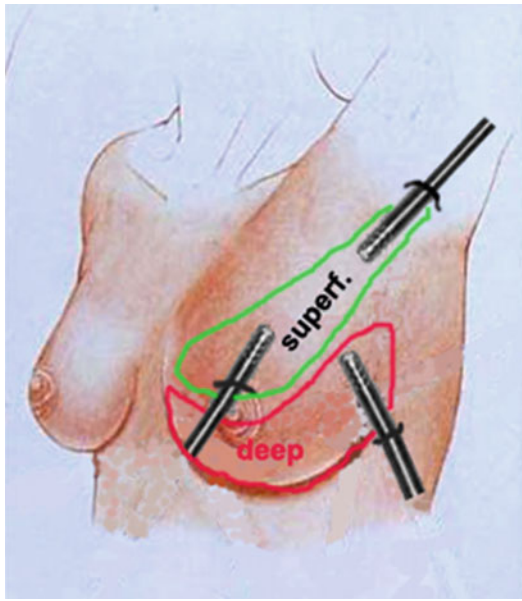

Fig. 28.11 Incisions placed at the inframammary crease, axilla, and areola margin: upper quadrants, superficial layers, 2–3 min; lower quadrants, deep layers, 7–20 min

The surgical planes, with good crisscross tunneling and adequate undermining, are routinely followed, as planned in the preoperative drawings. If large undermining is required for skin retraction, the superficial layers are treated initially. Then the deeper planes are reached, more time is spent in thicker areas. Surgeons inexperienced in the procedure should be especially cautious when performing the technique, particularly in the subdermal planes [9–12, 15–19].

28.5.4.2 Subcutaneous UAL Undermining

Together with UAL application to the fat layers, starting from the deeper layers and progressing to the more superficial ones, it is advisable to thin the superficial layer of the subcutaneous tissue of the upper and lower quadrants by using a different angle pattern, as in standard lipoplasty [20, 21]. This superficial undermining with low-frequency ultrasound energy helps to enhance the retraction of the breast skin and to redrape the breast skin to the newly shaped and reduced mammary cone (Fig. 28.11).

28.5.4.3 Optimizing Outcomes

To facilitate these maneuvers, a second tiny incision is often placed at the axilla and (sometimes) at the areola border. This helps the superficial work of the probe. The undermining has to be complete, with full liberation of all adherences with the deeper layers. The purpose is to thin the dermal flap all over the breast tissue, thus maintaining its vascularity, sensibility, etc.

Vaser is selective; does not interfere with the vascular network of the dermal tissue, if properly performed since it spares the connective and supporting structures of the skin [22]; and showed the great potential of the dermal layer in wound contracture. As much as the dermis is thinned, much of the contraction will result providing the tissue vascularization preserved. And this is what happens at all tissue when superficial dermal thinning is realized.

Tissues contract more easily, and combined with the gravity forces which help the upward rotation of the gland (when decreased in weight), the final result is a greater contraction of the breast, with a superior antigravity effect.

28.5.4.4 Postoperative Care

Suction drainage is routinely applied in the breast for at least 24–48 h. A custom-made elastic compression support (silicone-backed adhesive foam pads) is applied for 7–10 days, and a bra completes the dressing. These items together with skin redraping help support the breast in the immediate postoperative period.

28.6 Clinical Results

Results were visible immediately after surgery with the skin envelope redraped nicely and nice contour of the new breast shape and mound. The skin and treated breast tissue appeared soft and pliable. The elevation of the nipple-areola complex resulting from skin contraction and the rotation of the breast mold were immediately visible. The major postoperative nipple-areola complex elevation was 5 cm.

Emulsification of fatty breast tissue ranged from a minimum of 300 mL per breast in mild

reductions and breast lifts to a maximum of 1200 mL of aspirate for each breast in large breasts.

The author was able to easily obtain a mean of 500 mL of fat emulsion from each breast, after infiltration of 700 mL of Klein's modified solution for tumescence, followed by wide thinning of the subcutaneous breast envelope, to allow skin redraping. Elevation of the nipple-areola complex up to 5 cm was obtained in large-volume reductions in combination with thinning of the subcutaneous layer.

There was no evidence of suspicious calcifications resulting from surgery at the 5-year postoperative follow-up. Essentially, an increase in breast tissue fibrosis was noticeable in the postoperative mammograms, which was responsible for the new consistency, texture, and tone of the breasts. The increase was also responsible for the lifting of the breasts (Figs. 28.12, 28.13, and 28.14).

28.7 Mastopexy

Vaser can be applied in breast surgery and also in clinical cases which present minor degree glandular ptosis. As we know, by decreasing the volume of the breast, it is normal to have an upward rotation of the gland itself. Also the areola tends to shrink when the underlying tissue is diminished in size and volume. The upward rotation of the breast and the retraction can finally elevate the breast by 2–4 cm from initial position (Fig. 28.15). The result is already visible a week after surgery, with minimal bruising and edema (Fig. 28.16).

A supporting bra has to be applied for the first 4 weeks after surgery, despite that a similar bra should be advised forever in a patient with large breast or a tendency to ptosis, which with age is common to majority of female people.

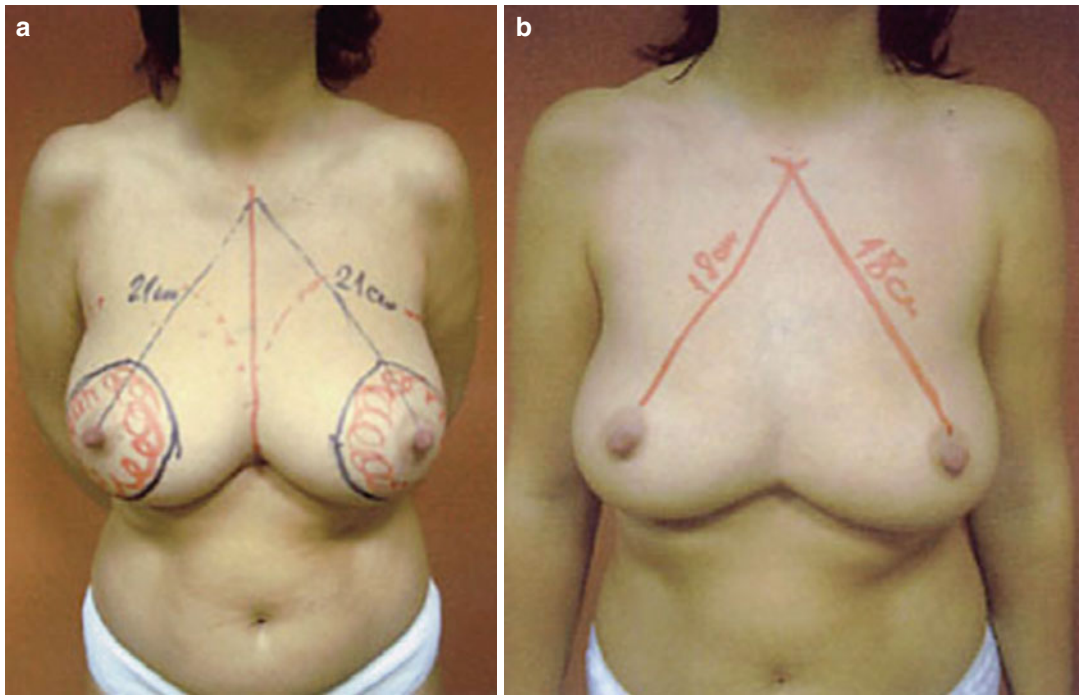

Fig. 28.12 (**a**) Preoperative breast hypertrophy and planning: red dotted area indicated fibrotic breast tissue not to be addressed. (**b**) One-year postoperative breast nipple raised from 21 to 18 cm from infrasternal notch

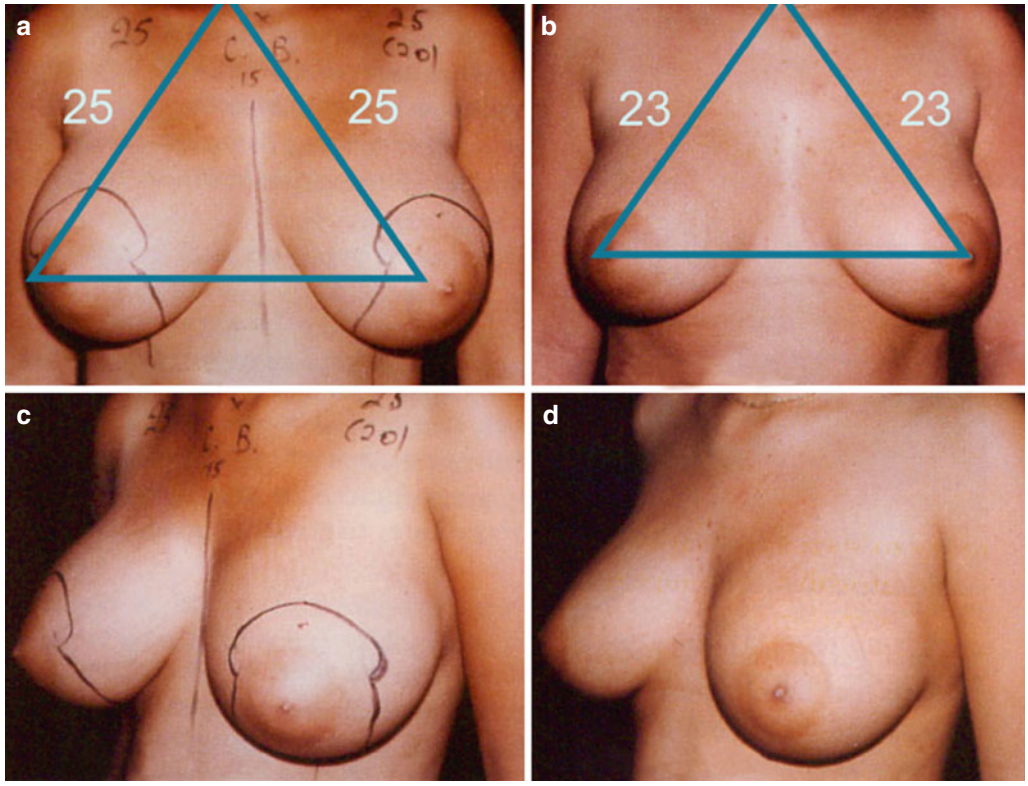

Fig. 28.13 (**a**, **c**) Preoperative 32-year-old woman. (**b**, **d**) Postoperative 6 months after 25 min of ultrasound-assisted lipoplasty through a submammary of 500 mL of fat per site

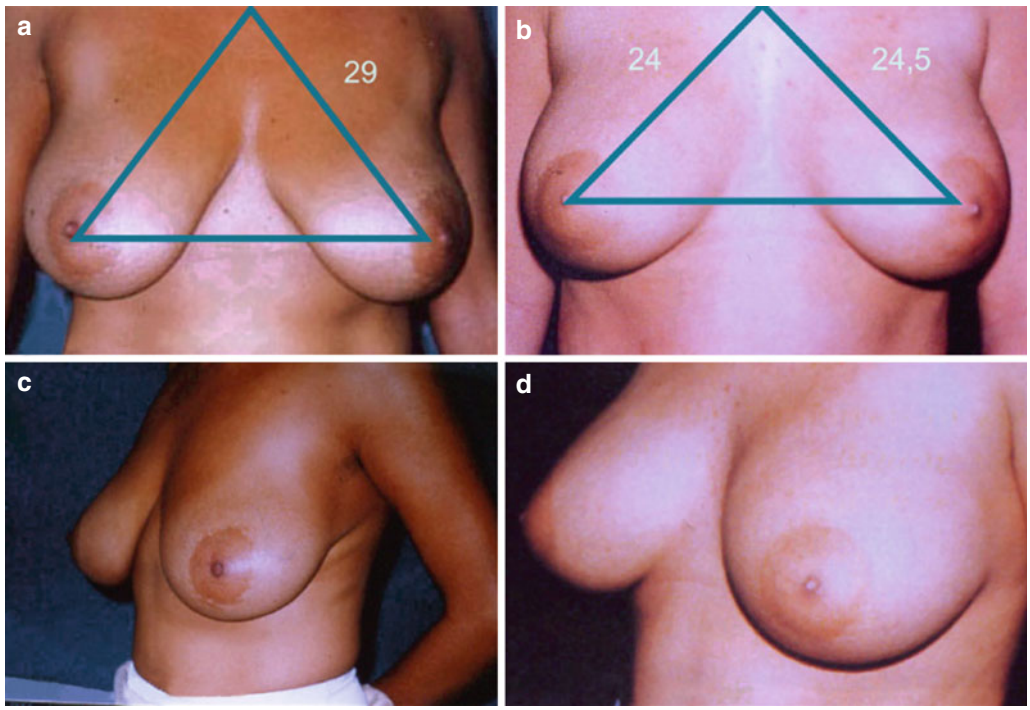

Fig. 28.14 (**a**, **c**) Preoperative 28-year-old woman. (**b**, **d**) Postoperative 6 months after 25 min of ultrasound-assisted lipoplasty through a submammary of 450 mL of fat per site

28.8 Histologic Changes

The breast tissue that underwent emulsification with ultrasound-assisted lipoplasty was analyzed histologically by Chun et al. [23]. They had operated on ten patients with large breasts with the Genesis Contour device (by Mentor HS, Santa Barbara, CA, US), with breast UAL. With open surgery they removed a breast specimen with a weight that varied from 430 to 1530 g. No gross pathological changes were noted at the time of surgery, and microscopic diagnosis included fibrocystic change stromal fibrosis. No atypia and no malignancy was found. The long-term follow-up shows clearly that the emulsified fat, when not aspirated, will eventually dissolve in few days or weeks. Area of relative fibrosis may appear at 1 and 2 months interval, and palpable nodes or lumps were a rare event in the large series of patients operated on from 2002 to 2006. There were 200 breast reductions and/or mastopexies that were performed (alone or in combination with other body contouring procedures).

28.9 The Passot Technique

In 2006, Nagy and Mc Craw [24] presented the combination of breast fat emulsification by Vaser with open surgery breast reduction. They reintroduced the technique of Passot [25] who in 1925 published the so-called Button mammoplasty or the no vertical scar reduction which became the most common method of breast shaping in Europe before World War II (Fig. 28.17).

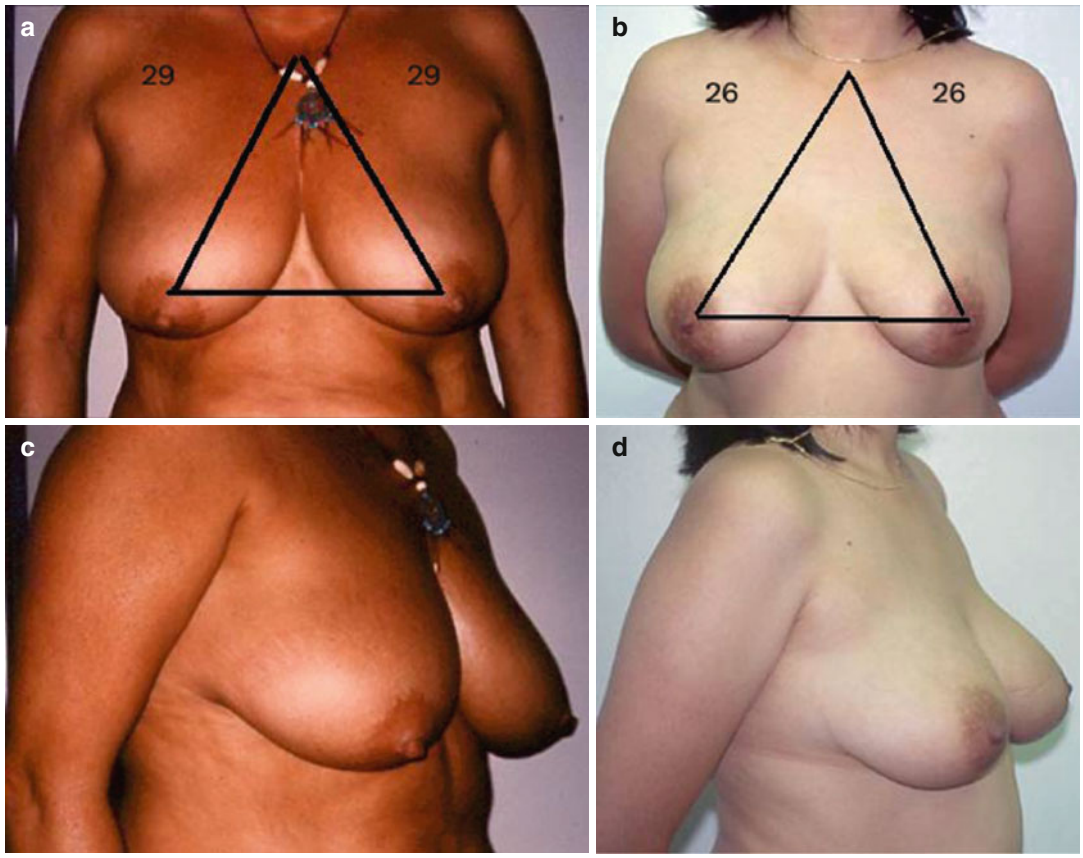

Fig. 28.15 (**a**, **c**) Preoperative 26-year-old patient. (**b**, **d**) Postoperative after 550 mL aspirate per side, UAL 21 min

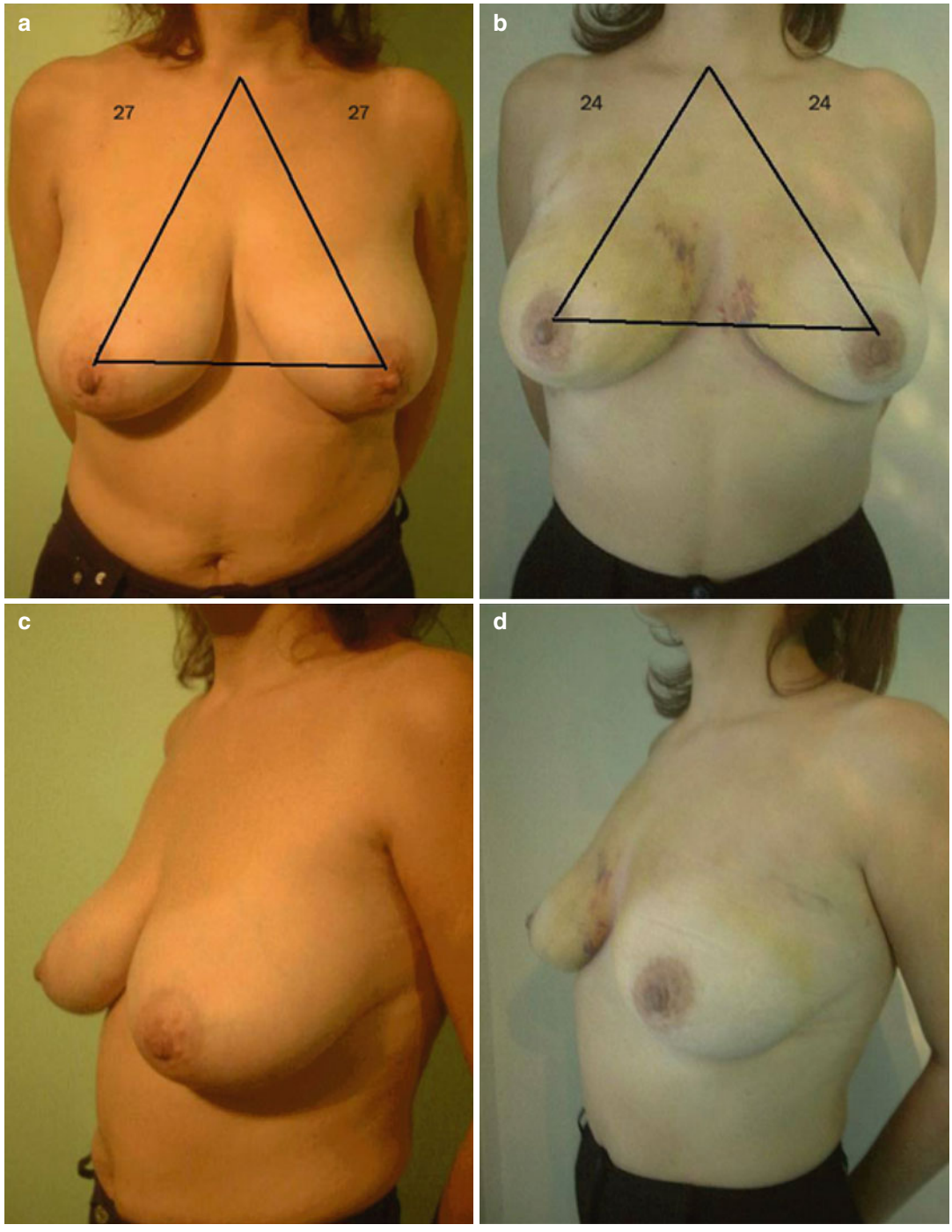

Fig. 28.16 (**a**, **c**) Preoperative 24-year-old patient. (**b**, **d**) Postoperative after 450 mL aspirate per side, UAL 22 min

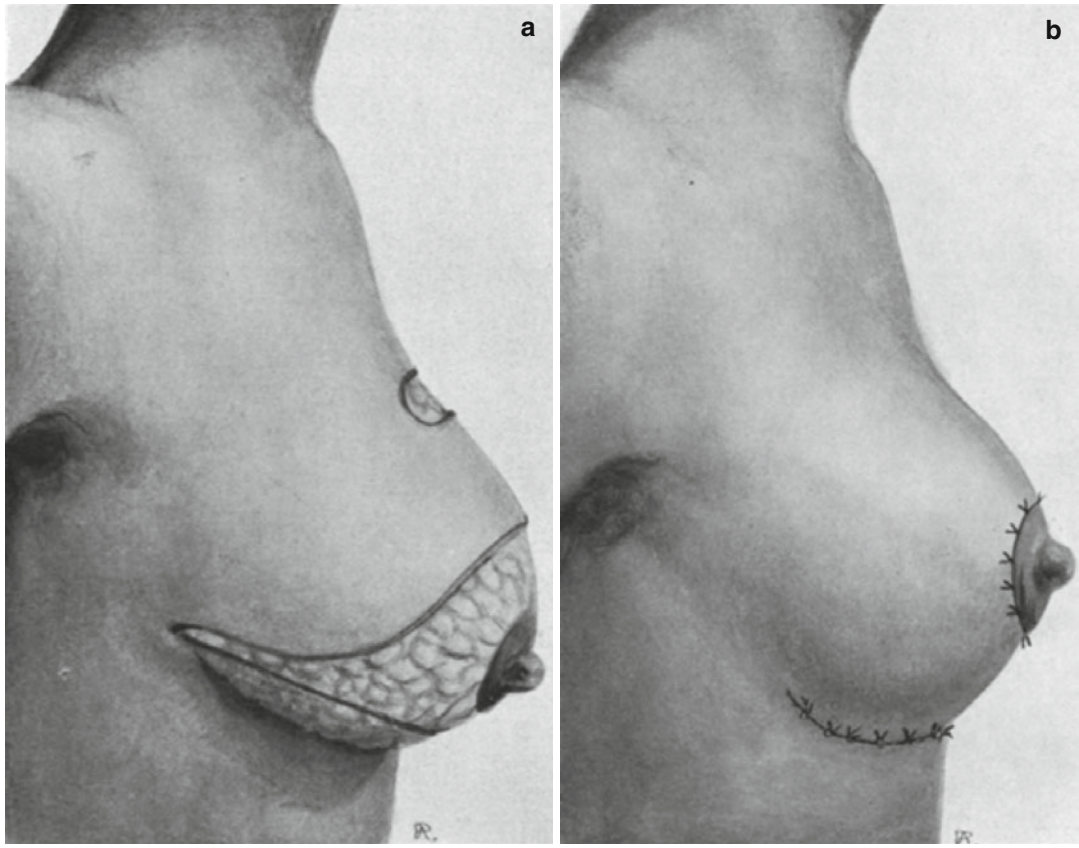

Fig. 28.17 (**a**, **b**) The Passot method

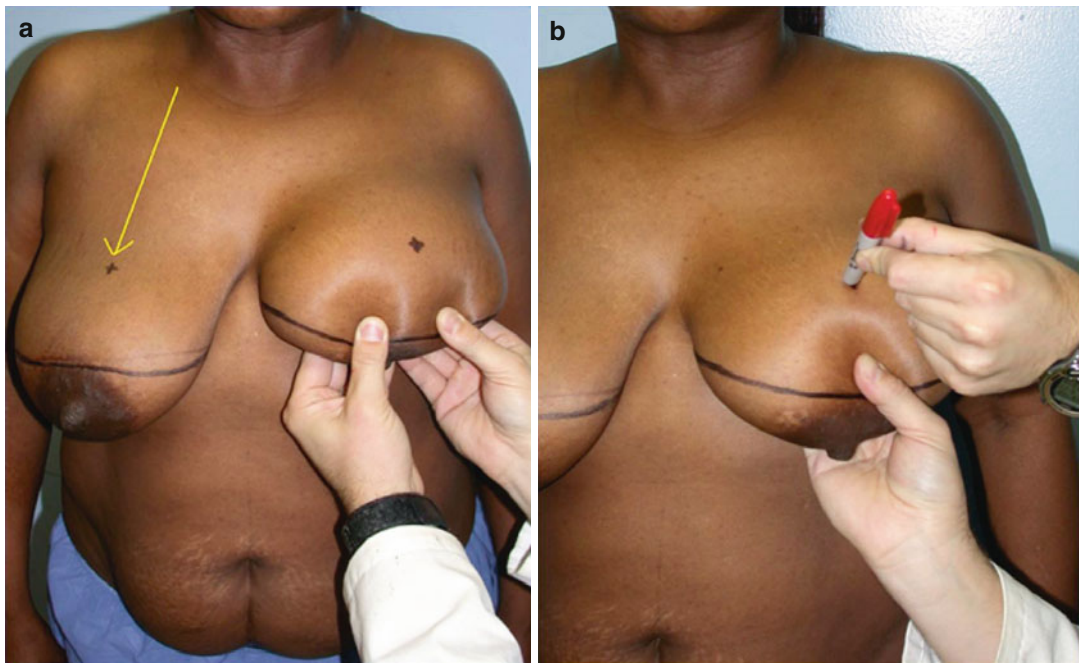

Fig. 28.18 (**a**) New inframammary visually marked at best range of 15–23 cm. (**b**) Pointing to inframammary fold. (*Arrow*) Show the point of entrance of the cannula

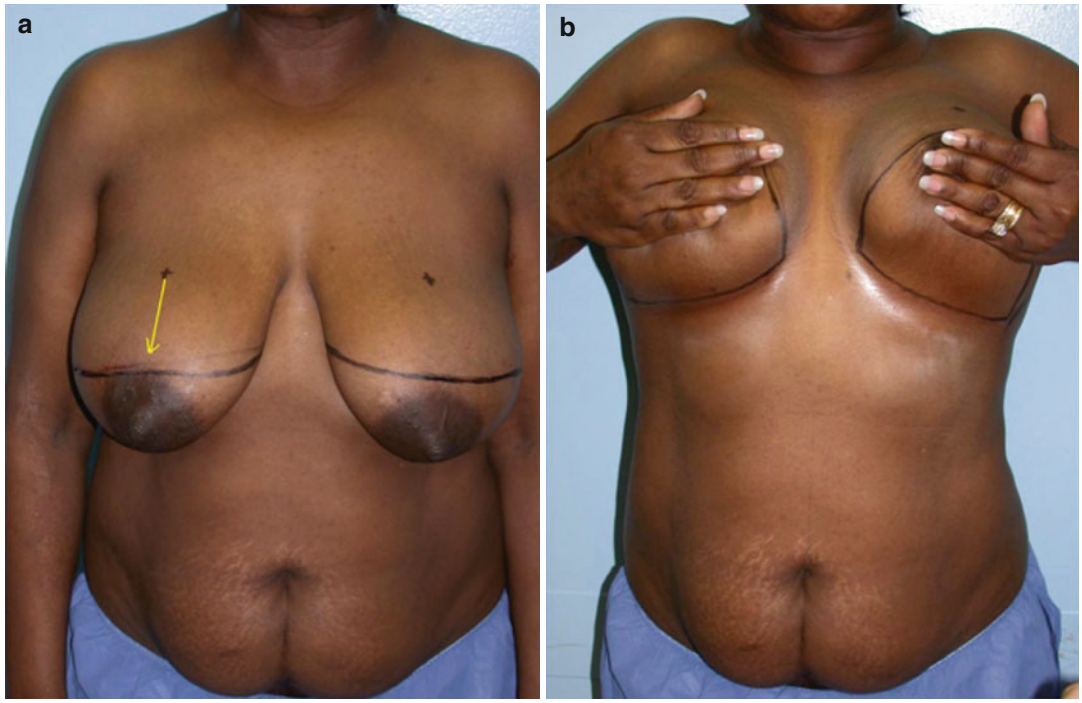

Fig. 28.19 (**a**) Flap margin 8–9 cm. (**b**) Inframammary fold. (*Arrow*) Show lines where the skin will be cutted

28.9.1 Markings

The new nipple position is marked, which is between 19 and 21 cm from midclavicular point (as in all classic measurement, it is the Pitanguy referral point). The new inframammary fold is marked, which ranges from 15 to 23 cm (Fig. 28.18). The flap margin (Fig. 28.19) is 8–9 cm below the new nipple site. The existing inframammary fold is marked. Medial (Fig. 28.20) and lateral (Fig. 28.21) points are marked.

28.9.2 Procedure

The upper quadrants of the breast are infiltrated with tumescent solution, and then Vaser is applied to emulsify the fat of this area (Fig. 28.22). In this case, no skin protector is applied, as the skin in this area is due to be deepithelialized for breast reduction. After completing aspiration of emulsified fat, the lower flap is detached from the chest wall, with a central large inferior pedicle based on perforators from the pectoralis muscle (Fig. 28.23). The upper quadrants, already treated with Vaser (Fig. 28.24), show the network of the subcutaneous breast tissue, as it appears after emulsification of fat and aspiration. All the supporting structures of the skin, as elastic bundles, vessels, nerves, and connective supports, are conserved. This pattern is similar to what happens in close breast reduction.

As the flap is reduced, it is advanced to fill the empty space (Fig. 28.25). The new nipple is positioned and centered on its pedicle (Fig. 28.26).

The Passot technique combined with Vaser has been applied to several types of breast ptosis. This technique has been performed on large reduction (up to 2900 g per side) (Fig. 28.27) or on the so-called long breast (Figs. 28.28, 28.29, 28.30, and 28.31) with 1500 g removal per side. The typical case where the Passot technique is combined with Vaser is a moderate degree pto-

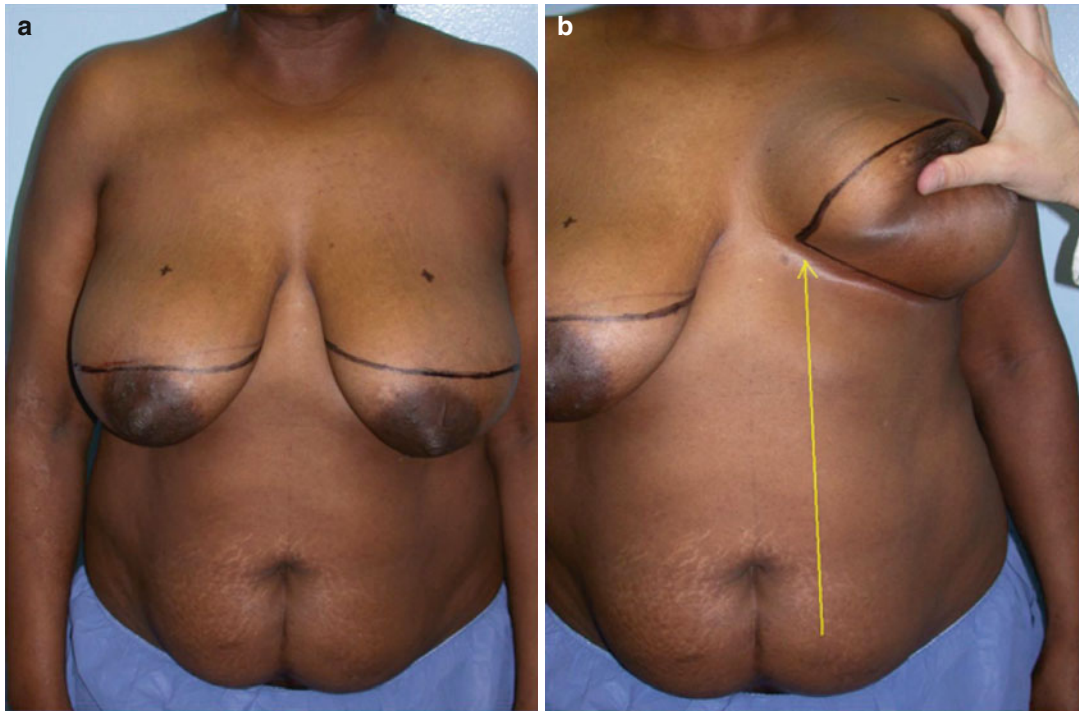

Fig. 28.20 (**a**, **b**) Medial point. (*Arrow*) Show lines where the skin will be cutted

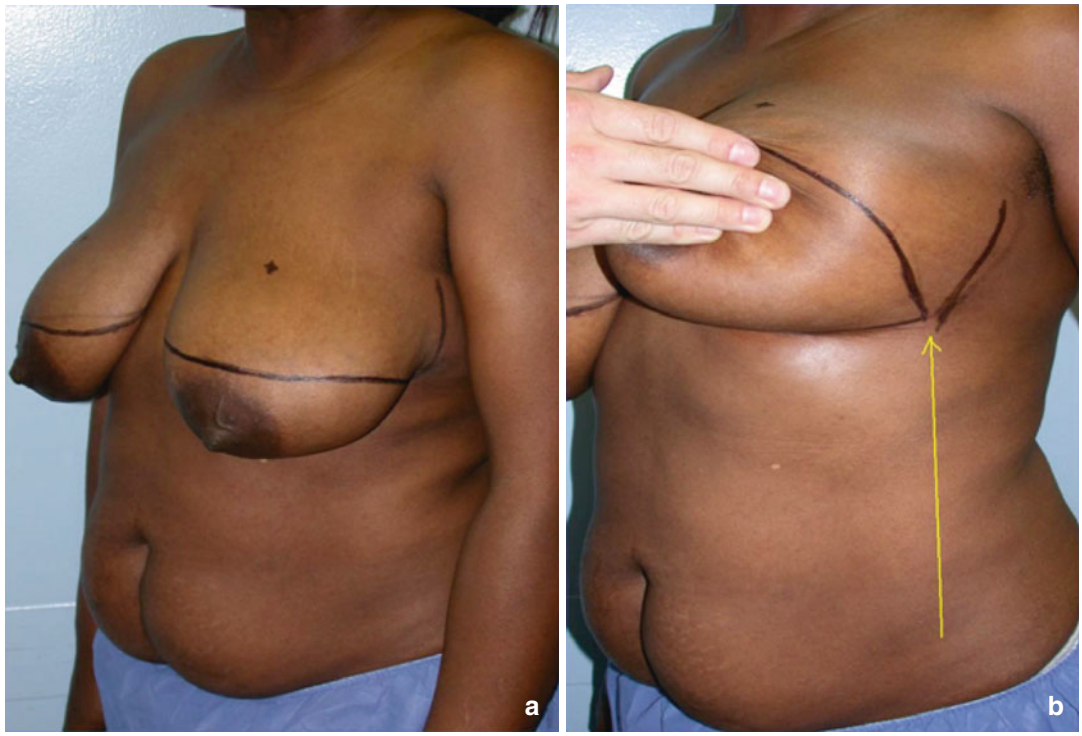

Fig. 28.21 (**a**, **b**) Lateral point. (*Arrow*) Show lines where the skin will be cutted

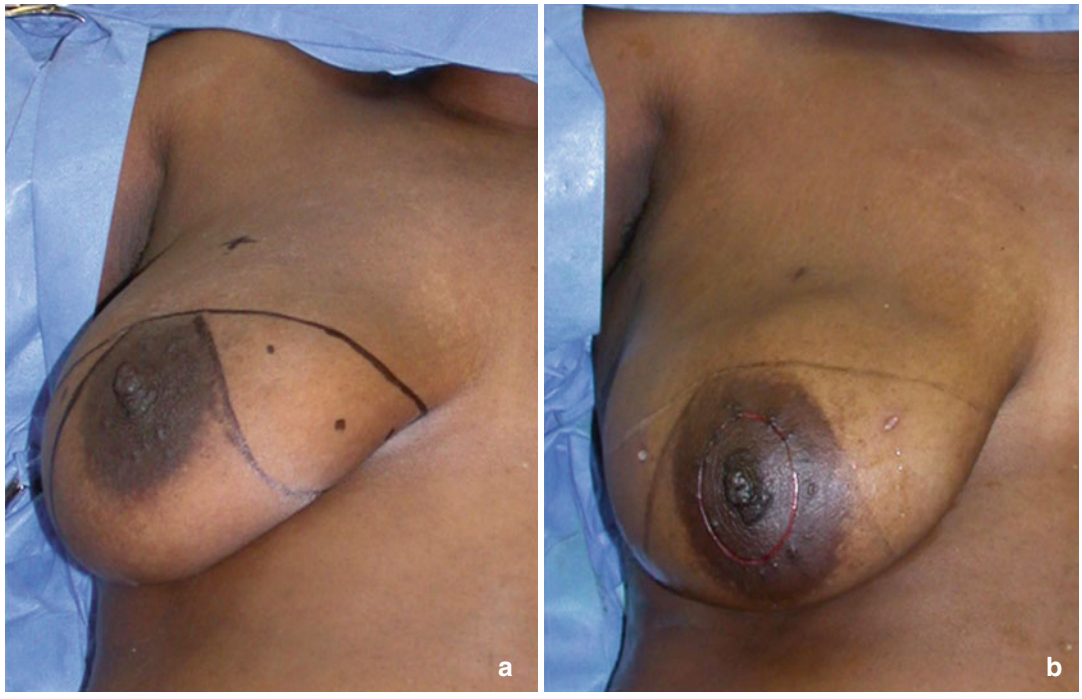

Fig. 28.22 (**a**) Before injection. (**b**) After Vaser and 500 mL aspiration

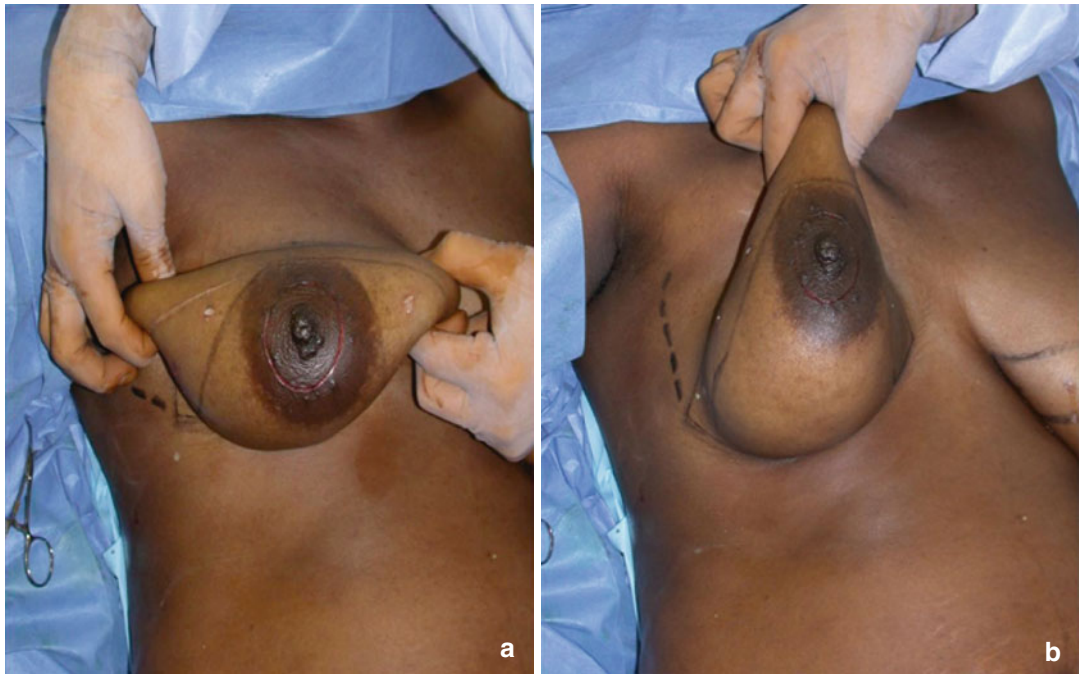

Fig. 28.23 (**a**) After 500 mL aspiration. (**b**) After 500 mL aspiration

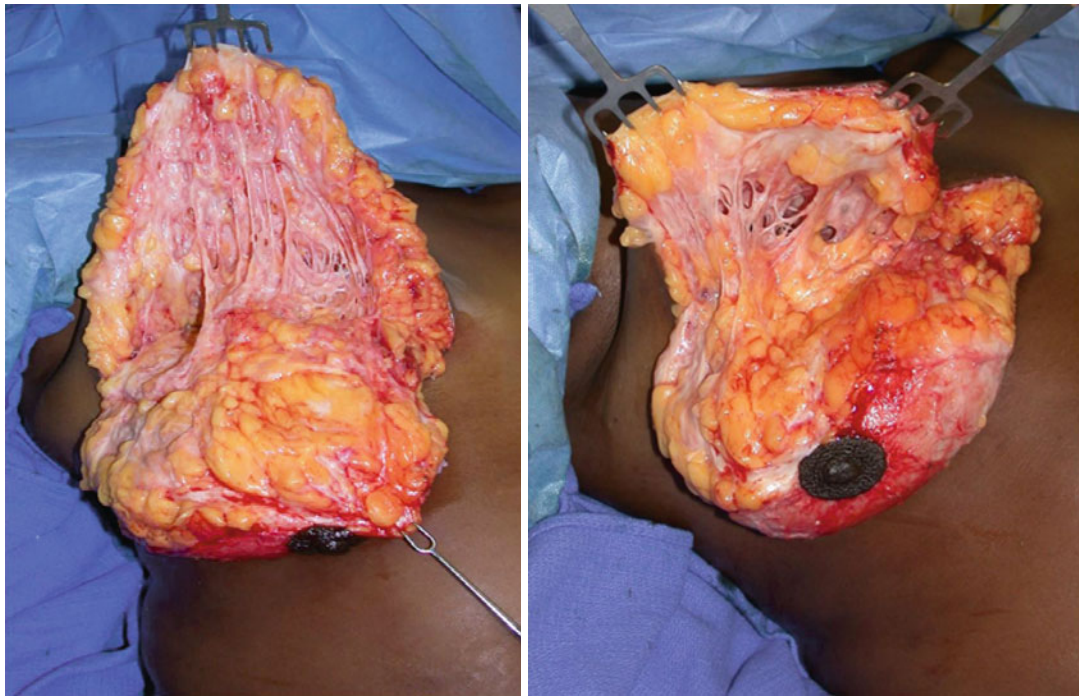

Fig. 28.24 (*Left* and *right*) Vaser effect

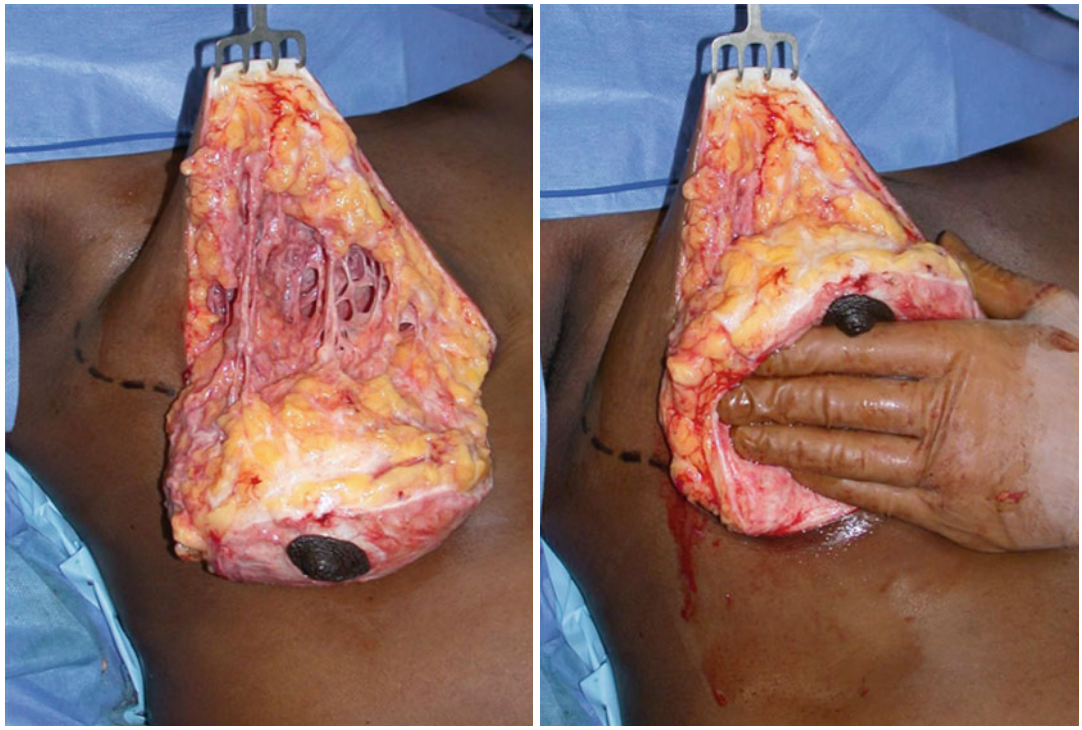

Fig. 28.25 (*Left* and *right*) After 500 mL aspiration

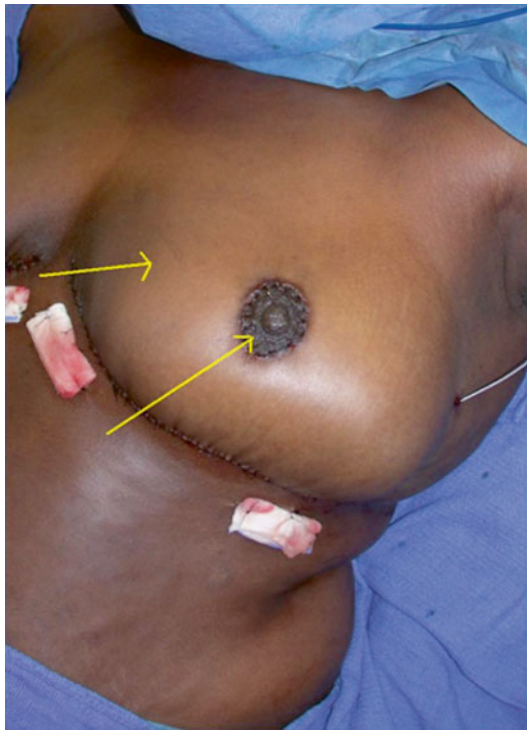

Fig. 28.26 Method: accentuate medial fullness and center nipple on pedicle. Both (*arrows*) to indicate the medial fullness and the centered nipple after surgery

sis, 26–28 cm from midclavicular point, with a mild to moderate hypertrophy (Fig. 28.32). Results are satisfactory and tend to improve by time.

The secrets of the success of the Passot technique combined with the breast reduction are:

1. Shaping under control the upper and lower quadrants of the breast.
2. Maintaining the vascularization of the upper quadrants by using Vaser, as it is a selective technique of emulsification.
3. Repositioning of nipple-areola complex without tension, which ensures good scar (no distortion, no widening).
4. Surgeons must possibly reconsider the priority in scar selection for breast reduction. For most women, the inframammary scar is preferable to the vertical scar, as less visible, despite it is longer. This could be a subject of debate among modern plastic surgeon who advocated the short vertical scar techniques for all types of breast reduction.

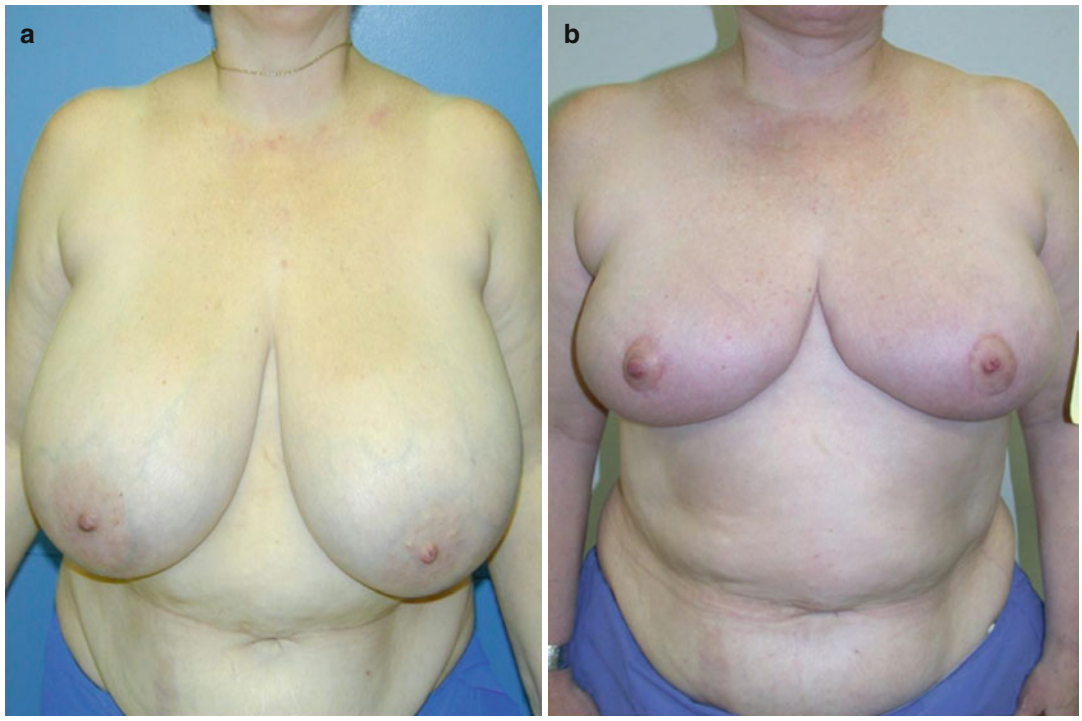

Fig. 28.27 (**a**) Large reduction: (*Left*) preoperative. (**b**) Postoperative following 2900 g per side

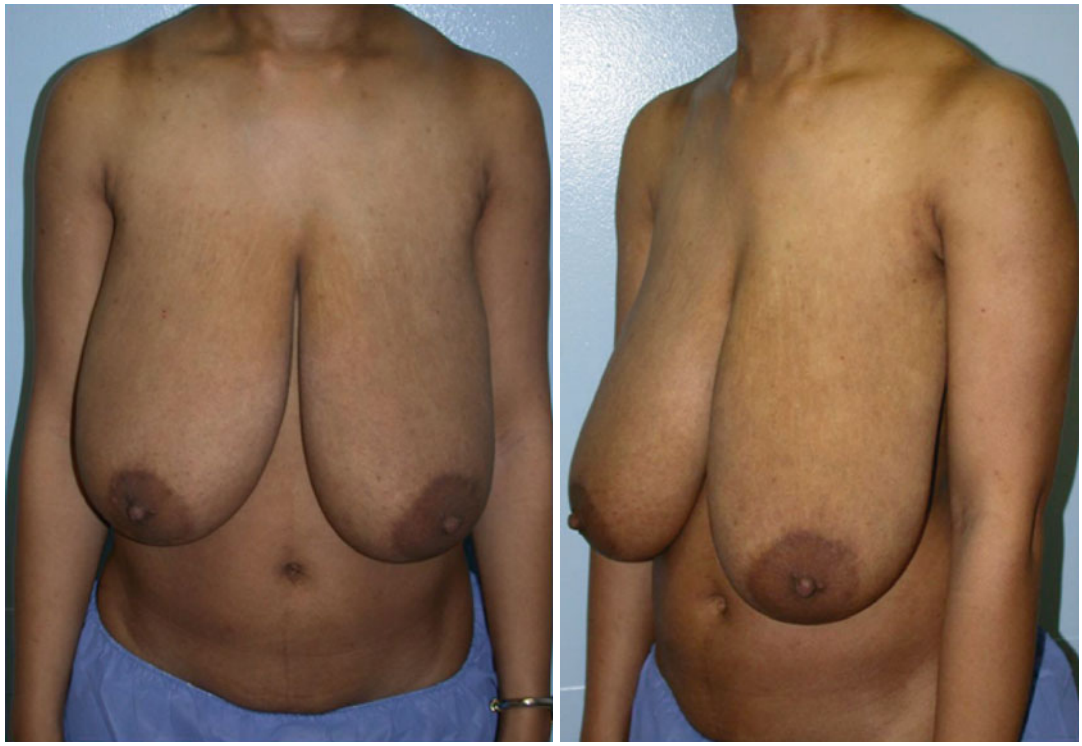

Fig. 28.28 (*Left* and *right*) The long breast

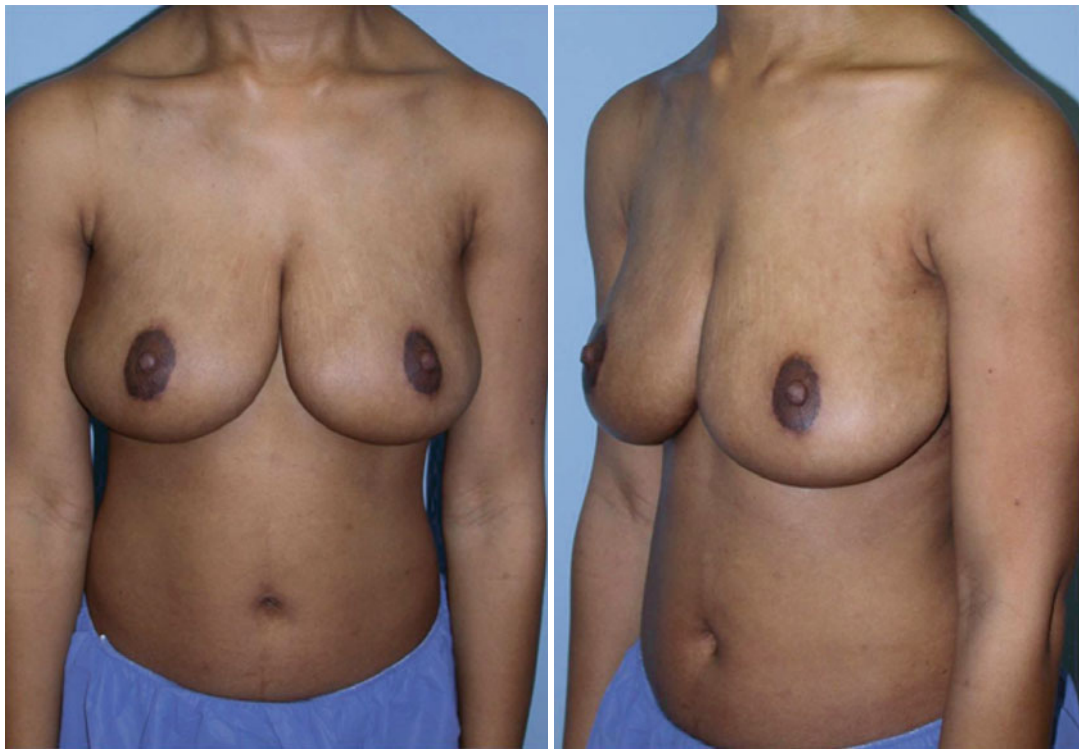

Fig. 28.29 (*Left* and *right*) Five months postoperatively. 1500 g per side

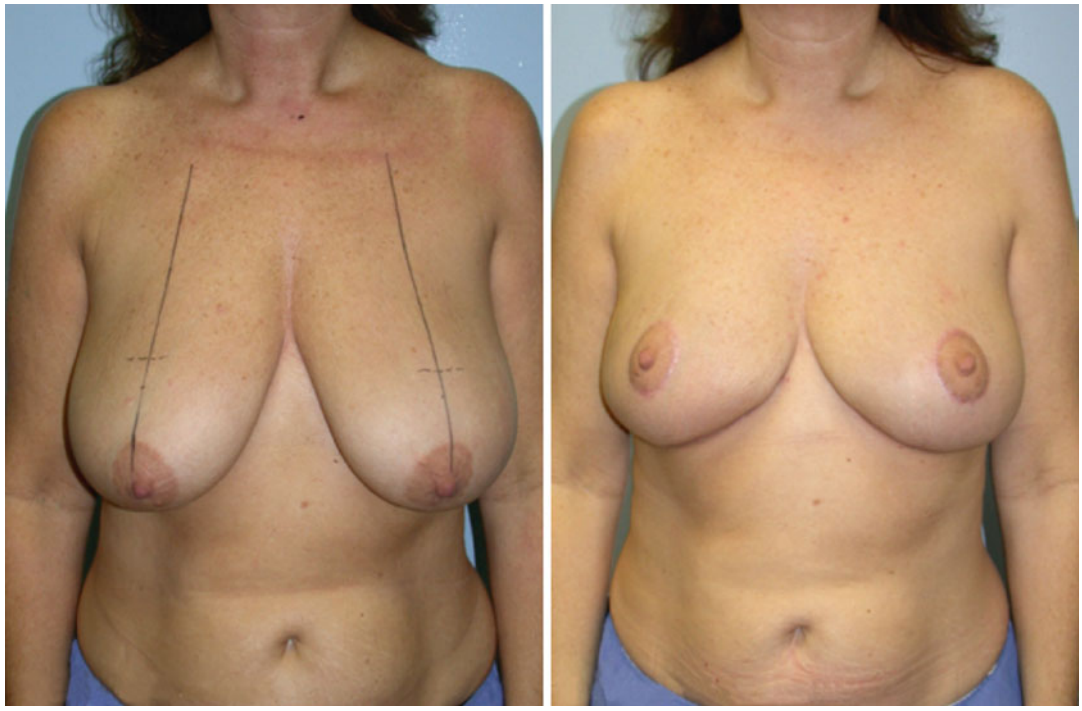

Fig. 28.30 (*Left*) Preoperative patient. (*Right*) Mastopexy without excision

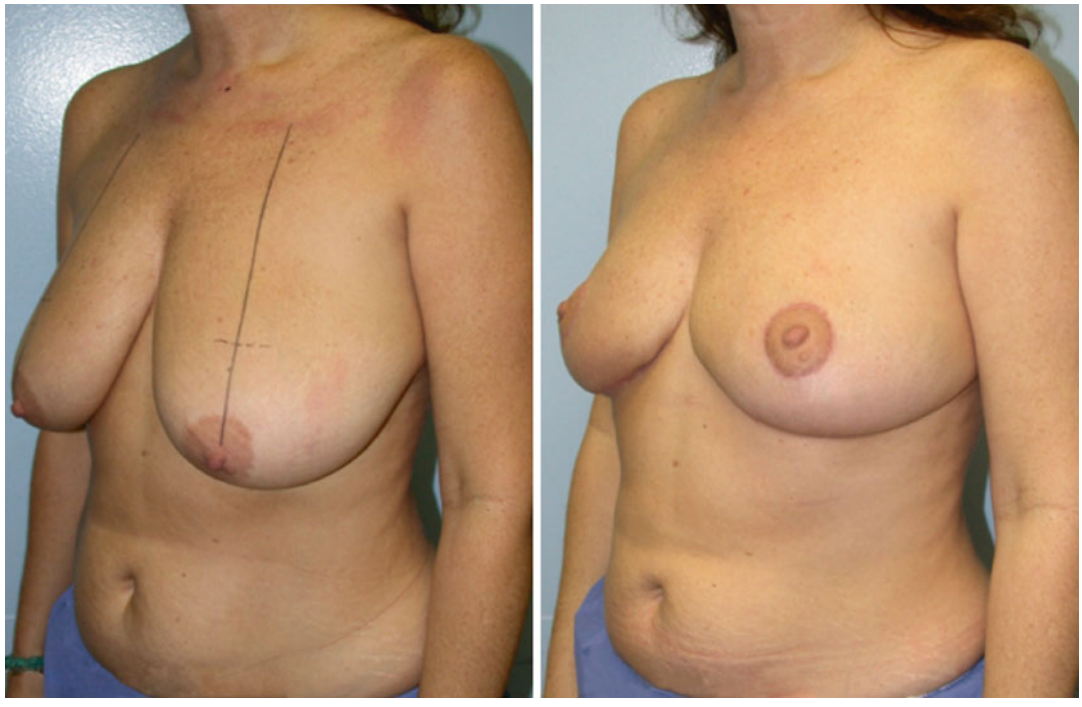

Fig. 28.31 (*Left*) Preoperative patient. (*Right*) Mastopexy without excision

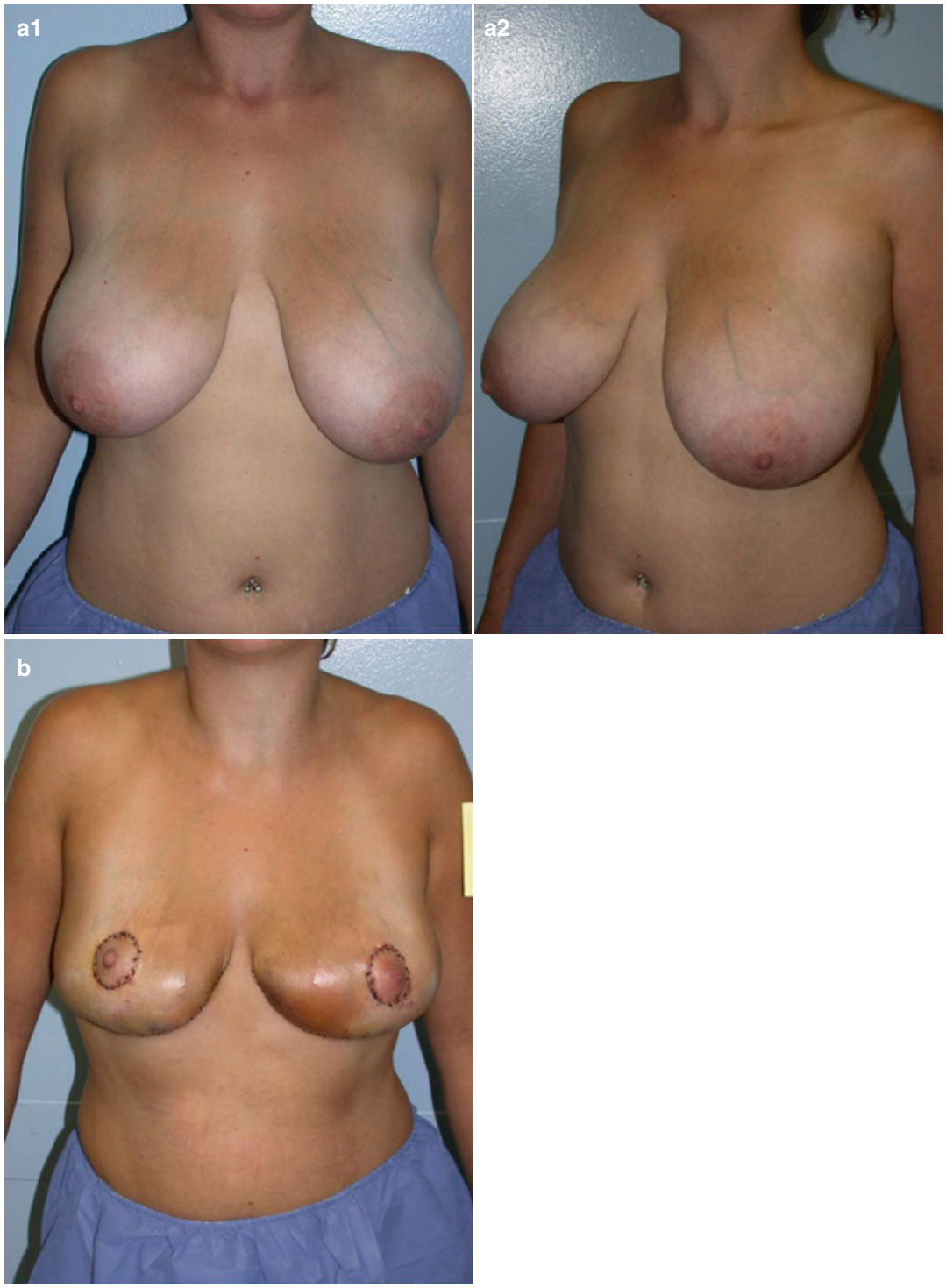

Fig. 28.32 (**a**) (*Left* and *right*) Preoperative patient. (**b**) Three days, 600 g removed from each side. (**c**) Two months. (**d**) Five months

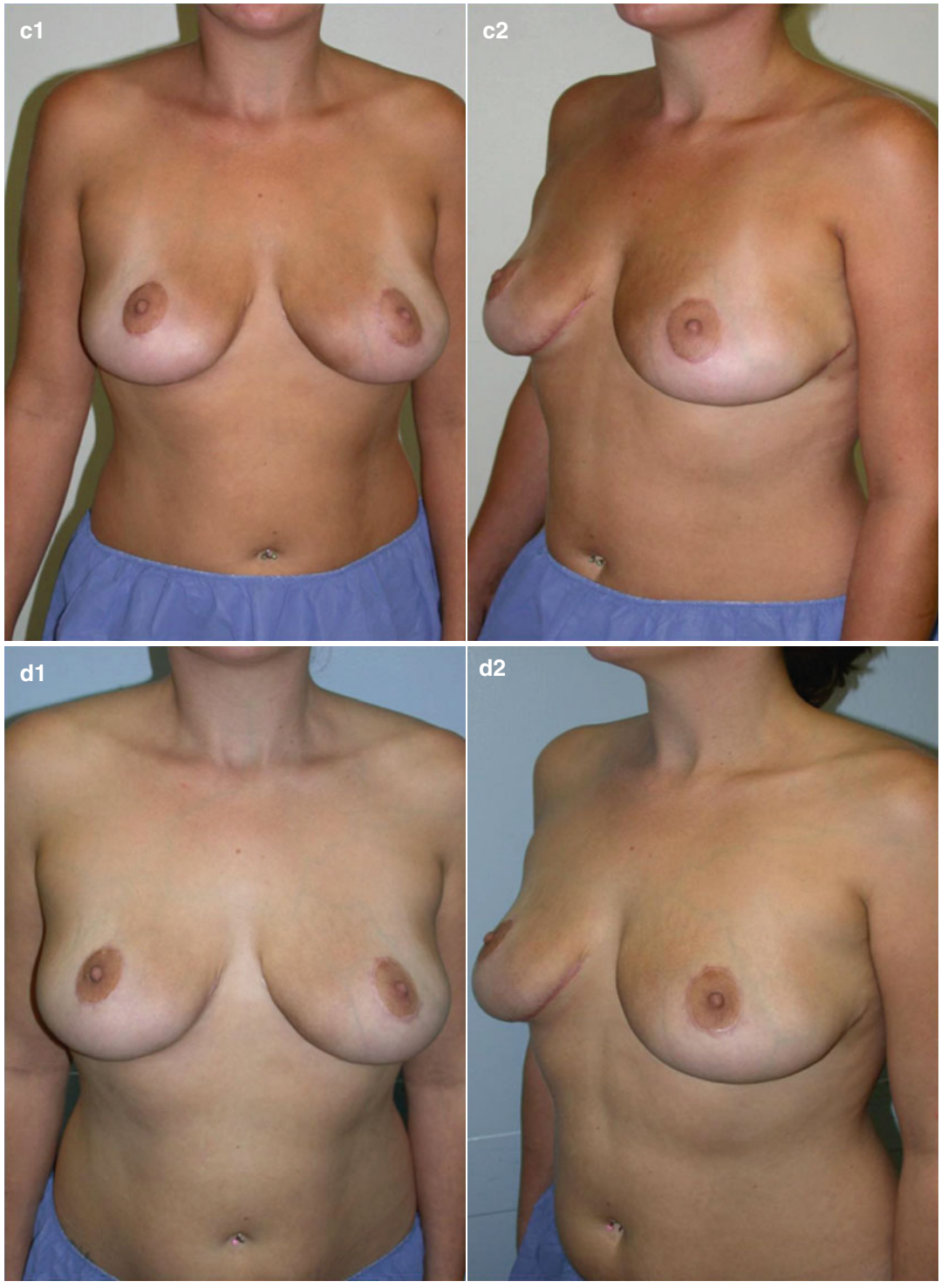

Fig. 28.32 (continued)

28.10 Complications and Their Management

No major complications occurred in the author's series of patients. It should be emphasized that such good results require extensive experience with UAL. As stated by a task force on UAL established by the American Society for Aesthetic Plastic Surgery (ASAPS), the Plastic Surgery Educational Foundation (PSEF), the Lipoplasty Society of North America (LSNA), and the Aesthetic Society Education and Research Foundation (ASERF), the learning curve for UAL is longer than that for standard lipoplasty.

Specifically, practitioners must learn how to work close to the subdermal layer with a solid titanium probe to defat this layer and obtain good skin retraction while avoiding complications, such as skin burns and skin necrosis. To safely work close to the skin, two conditions are mandatory. The surgeon must be experienced in ultrasound-assisted body contouring, and the correct ultrasound device (one that is able to maximize the cavitation's effects while minimizing the thermal effects) must be selected.

28.10.1 Skin Necrosis

Fat necrosis with secondary tissue induration is a typical sequela of ultrasound surgery. When it is localized in small areas, such necrosis can be treated with massage or local infiltration of corticosteroids to soften the area.

28.10.2 Loss of Sensation

Loss of sensation is generally limited to the first 3 weeks after surgery. Recovery is rapid because the central cone of the breast is composed mainly of pure parenchyma and is not touched during surgery. Skin sensation is recovered in a few weeks time.

28.10.3 Hematoma

Hematoma formation is another potential complication, though no cases occurred in this series.

28.10.4 Mastitis

Mastitis, an inflammatory response of the breast parenchyma to surgery, occurred in a few patients early in the series. Once surgery was avoided for patients at or near their menstrual period, only a minor inflammatory response was noted. When encountered, mastitis rapidly subsided with immediate treatment consisting of oral anti-inflammatory drugs and wide-spectrum antibiotics for 3 days.

28.10.5 Seroma

Seroma formation is a potential complication of any breast surgery. Regular application of suction drainages and breast compression for several days with a foam pad and a bra prevent this event.

28.11 Selectivity and Specificity of Ultrasound

Large amounts of fat are often found in patients with breast hypertrophy, even among thin adolescents. Lejour and Abboud [14] emphasized that once the fat is removed by lipoplasty before breast reduction, the proportion of glandular tissue, connective tissue vessels, and nerves is increased. These structures are important for maintaining vascularity, sensitivity, and lactation potential. Unlike fat, they are not likely to be affected by patient weight fluctuations. Lejour [13] affirmed that if the breasts contain substantial fat, weight loss may result in breast ptosis. The degree of recurrent ptosis can be minimized if lipoplasty is performed preoperatively to reduce the fatty component of the breasts. This observation anticipated the great potential of UAL for breast surgery.

The clear limits of standard lipoplasty with mechanical indiscriminate destruction of fat and surrounding elements followed by power aspiration of the destroyed tissue are particularly enhanced in breast surgery, where specialized structures (e.g., lactation ducts, vessels, sensitive nerves, elastic bounding structures of the subcutaneous tissue) have to be carefully preserved.

Because it is a selective technique, UAL may be applied in breast surgery to destroy and emulsify only the fatty component of the breast tissue without affecting the breast parenchyma for which the ultrasound energy has no specificity. The specificity of the technique is connected with the cavitation phenomenon and the efficiency of the system hinges on the type of the titanium probe used and the energy level selected. Lejour [13] argued that the suctioning of breast fat also made the breast suppler and more pliable, which facilitates shaping, especially when the areola pedicle was long. This consideration is particularly important with fatty breasts, which have a less reliable blood supply. These benefits are significantly increased by the use of UAL because the specificity of this technique spares the vessel network.

The selectivity of UAL was demonstrated by Fisher et al. [26] and Palmieri [27] in their studies on the action of the ultrasound probe in rat mesenteric vessels. Later Scheflan and Tazi [28] introduced endoscopic evaluation of UAL. They used a Stortz endoscopic system and camera (Stortz, Tuttlingen, Germany) to videotape the action of the titanium probe within the ultrasound device in the superficial layers of the subcutaneous fat, verified by needle depth, after standard infiltration with the tumescent technique.

UAL was performed with crisscross tunnels, and the procedure was recorded on videotape. An adjacent area was treated with standard lipoplasty. The technique was compared with standard lipoplasty, which was also endoscopically assisted and monitored. The authors found that standard lipoplasty appears to be the more aggressive technique, characterized by the mechanical destruction of the subcutaneous tissue, including vessels, nerves, and supporting structures, despite the use of 2–3 mm wide blunt cannulas.

By contrast, UAL spared vessels, nerves, and elastic supporting fibers. Alteration in breast tissue resulting from the use of UAL was a thickened dermal undersurface, markedly thickened vertical collagenous fibers, intact lymphatic vessels, and intact blood vessels. The horizontal and vertical thickening and shortening of the collagen in the dermis and ligamentous fibers are responsible for the remarkable skin tightening that follows subcutaneous stimulation with the ultrasound probe. The closer to the skin and the more complete the removal of fat from the intermediate subdermal space, the greater the skin-tightening effect. This is of great value in breast surgery, where volume reduction has to be accomplished by skin redraping and recontouring of the breast shape.

As noted by Lejour [13], retraction of the skin after standard lipoplasty cannot be expected to be sufficient to produce a satisfactory breast shape. Subcutaneous aspiration must be extensive to obtain the necessary skin retraction, and the risk of localized skin necrosis resulting from excessive superficial liposuction cannot be ignored [29].

28.12 Calcifications

Lejour [13] and Lejour and Abboud [14] argued that the risk of postoperative fat necrosis or calcifications was the reason many surgeons avoided the use of lipoplasty in the breast. The main cause of fat necrosis is breast ischemia brought about by extensive dissection or mechanical direct damage, with resultant venous drainage. This phenomenon is typical in open breast surgery. Calcification in breast reduction surgery may derive from area of fat necrosis or breast necrosis and subsequent scarring. Such calcifications are most often located at the incision lines (periareolar, or vertical scar in the inverted T approach), where more tension is placed in approximating the lateral and medial flaps. However, when the tension is too high, areas of necrosis could arise from the approximating suture and later cause calcifications that are visible on mammography. However, the risk of such complications in UAL procedures is quite low.

Calcifications in breast parenchyma are to be expected after any mammoplasty procedure. In reduction mammoplasty, it is preferable that they be localized along the breast scars [30]. When lipoplasty is performed in addition to the mammoplasty procedure, benign macro-calcifications are slightly more numerous in the parenchyma than they are in breasts reduced without lipoplasty. This may occur because of the trauma caused by lipoplasty or because lipoplasty suction is applied to the most fatty breasts, which are more prone in lipo-necrosis [31]. However, 1 year after fatty breast reduction with UAL, follow-up mammography revealed only a slight increase of small microcalcifications, similar to those found after other mammary procedures.

28.13 Potential Risks

In November 1998, a conference on UAL safety and effects was held in St Louis, MO, USA, sponsored by the ASERF and the PSEF at which a panel was organized in response to an article by Topaz [32] that raised questions about the safety of UAL. Topaz speculated that thermal effect and the free radicals generated during UAL might result in neoplastic transformation and other long-term complications, as a consequence of the physical effect known as sonoluminescence. Those attending the conference represented multiple scientific disciplines, including plastic surgery, physics, lipid chemistry, cancer biology, and mechanical biophysics. The participants agreed that scientists did not yet understand the mechanism of UAL action, though multiple mechanisms were probably involved, such as mechanical forces, cavitations, and thermal effects.

Additional research has revealed that long-term complications or negative bioeffects (including DNA damage and oxidation-free radical attack) are probably not serious safety concerns for UAL.

With reference to the application of UAL to breast surgery, the author investigated the histology of the breast fat tissue before and after UAL breast surgery (with serial biopsies at 6 months and 1 year after surgery) and the mammographic appearance of the breast before and 1, 2, and 3 years after surgery, particularly with respect to calcification. The results were evaluated by a senologist not directly involved with the clinical research [33]. Histologic studies revealed an increased fibrotic response to thermal insult, with a prevalence of fatty scar tissue, in all specimens evaluated.

Mammography showed a significant increase in breast parenchymal fibrosis, with a denser consistency and thicker breast trabeculae that were constant over time. The calcifications that appeared were benign and were typically small, round, less numerous, and more regular than those characteristic of malignancy. Comparison of the mammographic results typical of a standard breast reduction and those typical of breast reduction with UAL showed that microcalcifications are less likely to develop with UAL. It is likely that scar tissue caused by breast reduction with electrocautery or by necrosis resulting from the tension of internal sutures may more frequently cause calcifications or irregular mammographic aspects of the operated parenchyma. Particularly, in standard breast reduction surgery, they can appear at the areola line and at the site of the vertical scar.

From a mammographic viewpoint, the typical appearance of a breast reduction with UAL demonstrates predictably less scarring and fewer calcifications than those that occur in the standard open technique. Courtiss [34] reported similar mammographic evidence in a denser breast after breast reduction by lipoplasty alone. No malignancies were reported.

The question of whether potential lactation is affected by UAL remains unanswered. The technique was used for breast reduction and mastopexy in younger and older patients. In the younger group, 16 patients breast-fed their babies regularly. The other 14 patients were lost to follow-up. However, none of these patients or their gynecologists reported any problems to the surgeon or to the hospital, and no complications have been reported by other surgeons around the world who use this technique.

Conclusions

The use of UAL for reduction of fatty breasts and mastopexy is effective and safe when applied in selected patients and performed by a surgeon with expertise in ultrasound-assisted

body contouring. The selectivity of UAL enables emulsification of the fatty component of the breast parenchyma while sparing the glandular tissue and vascular network. Furthermore, long-term mammographic studies have revealed no alteration of morphology of the breast parenchyma resulting from this technique. The typical mammographic appearance of breast tissue after UAL is a denser breast.

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