40 Breast Reduction with Ultrasound Assisted Lipoplasty

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40.1 Introduction

Ultrasound energy can be applied to the adipose component of the breast parenchyma to reduce the volume of the breast mound in hypertrophic breasts. This technique has its main application in patients with fibrofatty and fatty breast parenchyma who are accurately selected before breast reduction and fixation with ultrasound-assisted lipoplasty is performed.

Ultrasound energy was initially used by Zocchi in 1988 to emulsify fat. He created a special tool consisting of an ultrasound generator, a crystal piezoelectric transducer, and a titanium probe transmitter. First applied to body fat to emulsify fat cells only, the other supporting, vascular, and connective components of the cutaneous network were spared; this technique was more recently used [1–12] in breast tissue, in both hypertrophic and ptotic breasts, to achieve breast reduction and correction of mild to medium ptosis.

The main effect of ultrasound energy is to decrease the fatty component of the breast tissue and to lift the breast, with visible scars. The advantages, disadvantages, and complications related to the procedure are discussed in detail below.

40.2 Patient Selection

The ideal candidate is the juvenile breast, in which there is normally fatty parenchyma, or the breast with

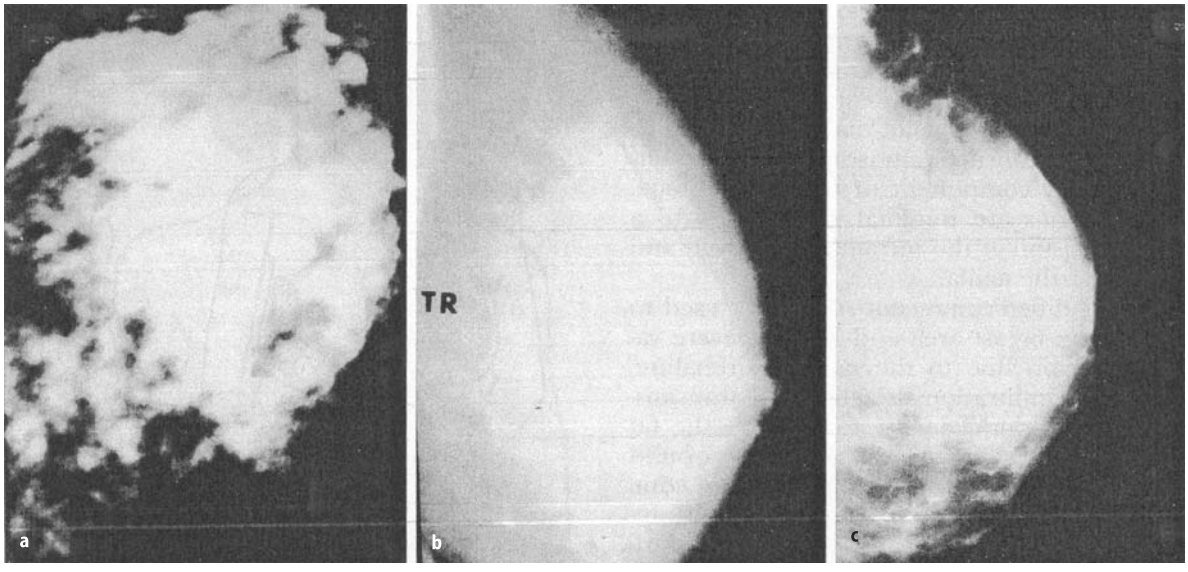

Fig. 40.1. Preoperative mammographic evaluations are used to identify candidates for ultrasound-assisted lipoplasty and breast reduction. **a** Typical fibrotic glandular tissue; this patient is not a candidate. **b** Typical fatty breast; this patient is an ideal candidate. **c** Fibro-fatty mixed gland; the patient is a candidate for lipoplasty of the posterior cone and upper and lower quadrants

postmenopausal involution breast parenchyma, both of which have good skin tone and elasticity.

The study of the patient who will undergo a breast reduction with ultrasound-assisted lipoplasty includes a mammographic study (Fig. 40.1), a breast clinical history and an evaluation of breast ptosis and the consistency of the breast parenchyma.

Each patient receives preoperative mammograms (anteroposterior and lateral views) for correct assessment of the nature and consistency of the breast tissue (fibrotic, mixed, or fatty parenchyma). The presence of fibroadenomas, calcifications, or other suspect masses on radiological images is double checked with a senologist (breast cancer specialist) and a radiologist with a high degree of competence in breast tissue resonance [13]. Patients with suspect mammograms (calcification), a history of breast cancer or mastodynia and patients who may be at risk for potential sequelae are not considered ideal candidates for the treatment.

Breast measurements are taken to assess preoperative and postoperative breast size and to determine the position of the nipple in relation to the clavicle and sternum, as follows. Breast sizers are usually used to evaluate preoperative and postoperative dimensions of the patient's brassiere (Fig. 40.2). A classic breast drawing is used to check the following preoperative and postoperative distances: from the midclavicular notch to the nipple, from the nipple to the submammary line, from the midclavicular notch to the submammary line, and from the nipple to the sternum (Fig. 40.3).

40.3 Technique

The steps for ultrasound-assisted lipoplasty are as follows [14]: (1) preoperative planning; (2) patient set-up; (3) tumescent infiltration; (4) ultrasonic treatment; (5)

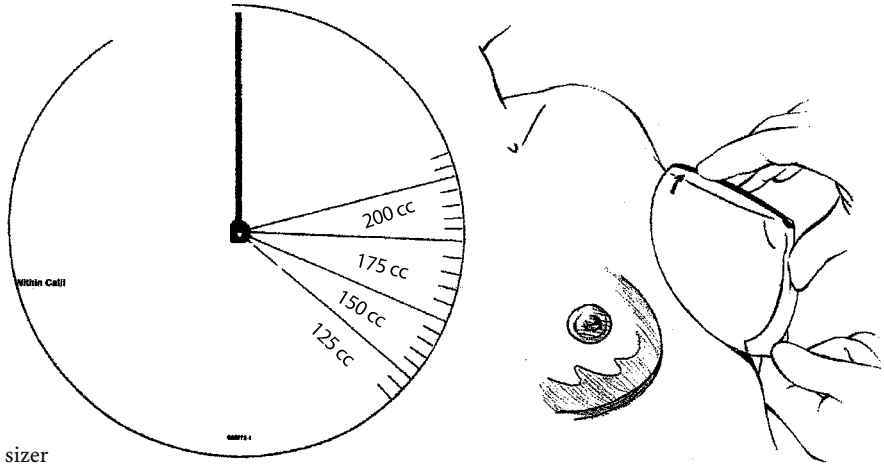

Fig. 40.2. An example of a breast sizer

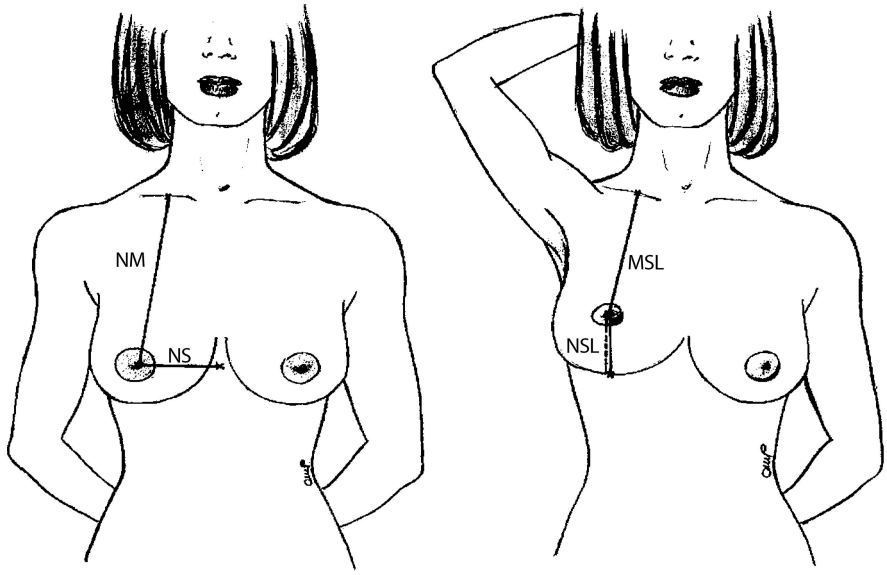

Fig. 40.3. Preoperative and postoperative measurements are taken of the following distances: *left* the distance from the midclavicular notch to the nipple (*NM*); the distance from the nipple to the sternum (*NS*); *right* the distance from the nipple to the submammary line (*NSL*); and the distance from the midclavicular notch to the submammary line (*MSL*)

suction of the emulsion; (6) manual remodeling; (7) subcutaneous stimulation with ultrasound (when required); and (8) postoperative care.

Ultrasound-assisted lipoplasty can be used as a unique method of fatty breast reduction [15] and fixation or as a temporizing measure to reduce breast volume and tighten breast skin, until a secondary operation with a less pronounced scar is feasible (such as periareolar double-skin breast mastopexy).

Often, in our experience, it is easy to obtain a mean amount of fat emulsion of 500 cc from each breast, after infiltration of 700 cc of Klein's modified solution for tumescence, followed by energic skin stimulation of the subcutaneous tissue, to allow skin redraping.

Two stab incisions (2 cm long) are necessary to allow the titanium probe to enter; the skin is protected from friction injuries with a specially made skin protector. We prefer to place these incisions at the axillary line and 2 cm below the inframammary crease (Fig. 40.4). With these two incisions, we can easily reach all of the breast tissue, working, as usual, in a criss-cross manner.

After preoperative marking (Fig. 40.5), fatty breast tissue is emulsified in the lateral and medial compartments, in the upper quadrants, and in the inferior aspect of the periareolar area (Figs. 40.6, 40.7). All of the periareolar area (a 5-cm circular area around the nipple-areola complex) is preserved, because this is where most of the glandular tissue is localized.

The deep portion, mostly fat, can be emulsified as well to allow natural rotation of the breast, to regain the natural breast shape, and to increase the elevation of the breast from its initial position, taken from the midclavicular notch (Fig. 40.7, left). Up to 4 cm of breast elevation can be obtained, after proper reduction and stimulation, to allow skin retraction and correction of the ptosis.

Routinely, a standard, 35-cm-long titanium probe is utilized. This probe has a diameter that tapers from 5.1 mm in the proximal portion to 4 mm in the distal portion.

The amount of breast tissue reduced is determined using the emulsified breast fat (including the tumescent solution infiltrated at the beginning of the procedure). The amount of aspirate ranges from a minimum of 300 ml for breasts undergoing mild reduction and

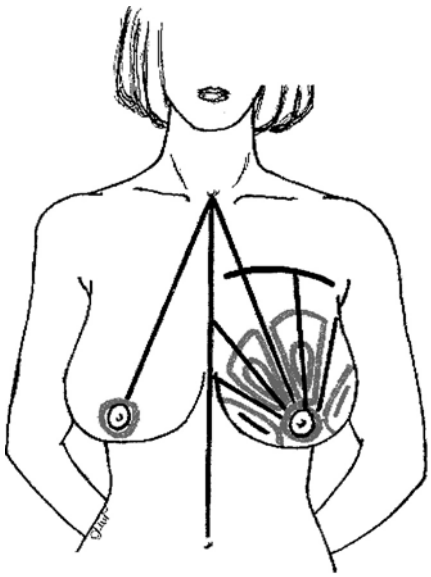

Fig. 40.5. During preoperative planning, a 5-cm-diameter circle is made around the areola to indicate the area that will not be operated on. *Straight lines* indicate lines of subcutaneous skin stimulation. The *rounded lines* indicate areas of thicker breast tissue

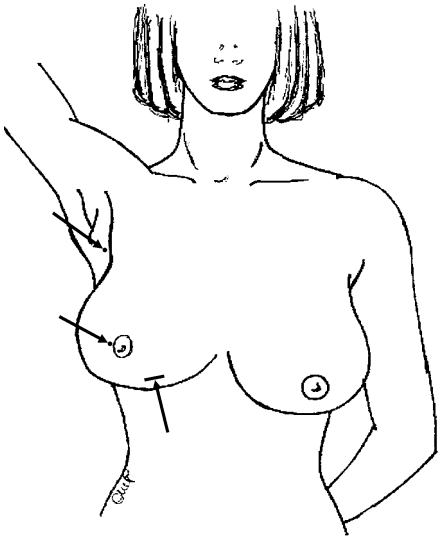

Fig. 40.4. The *incision lines* are shown at the axilla, the submammary fold, and the periareolar area

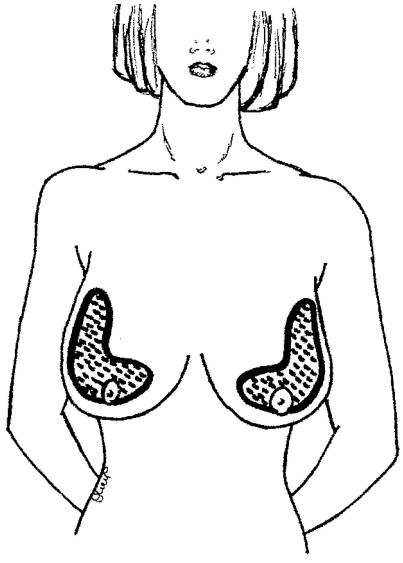

Fig. 40.6. Distribution of glandular tissue in the breast cone

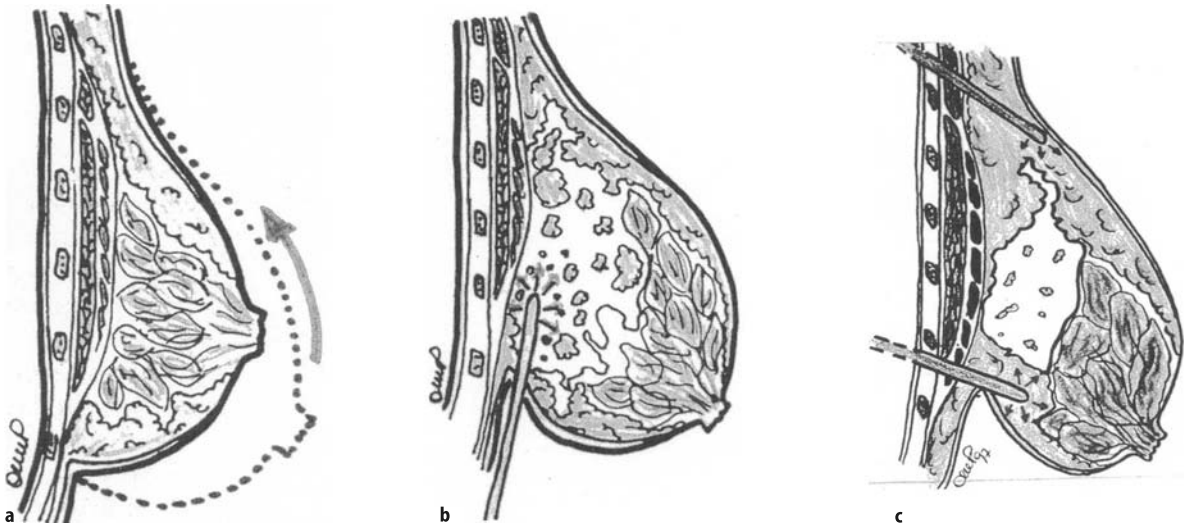

Fig. 40.7. a When the lower pole is thinned, the cone naturally rotates upward. **b** The titanium probe is used to emulsify fat at the lower breast pole. **c** When used to emulsify the subdermal layer of fat close to the skin, the probe stimulates skin retraction

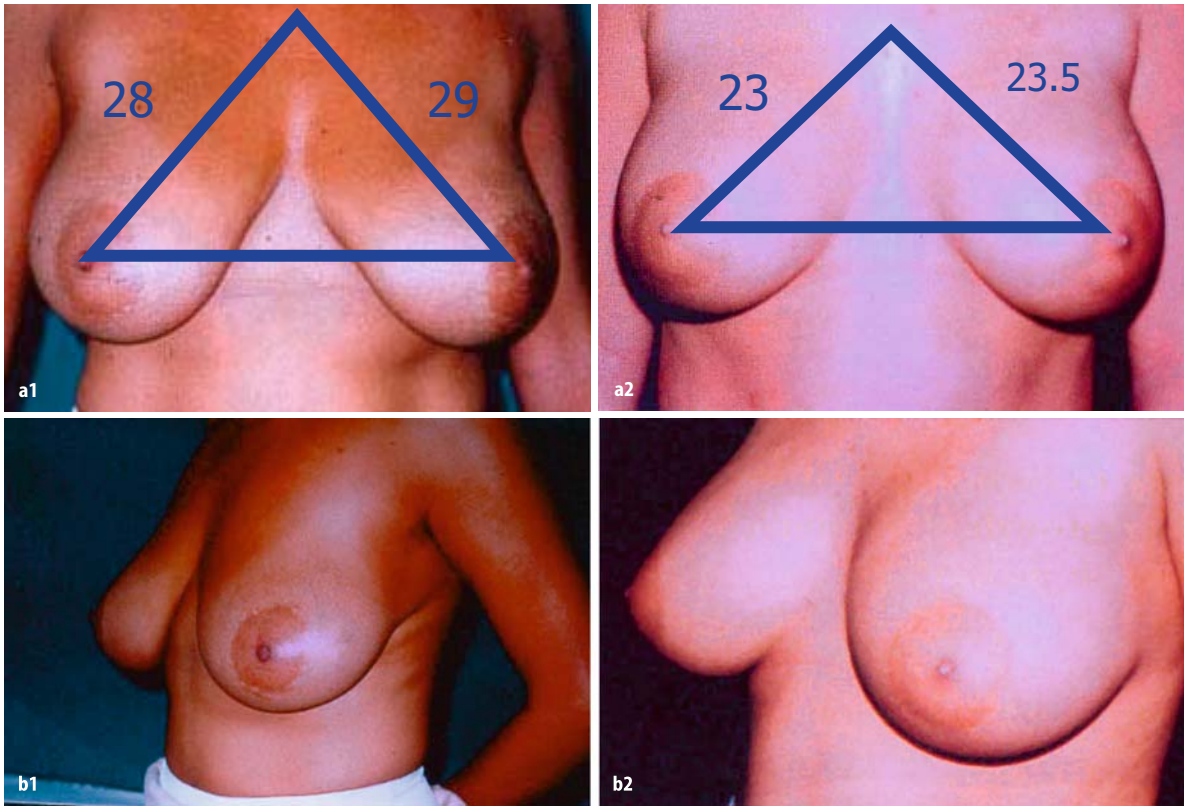

Fig. 40.8. a A 32-year-old patient with moderate breast hypertrophy and third-degree ptosis. **a1** Preoperative frontal view. **a2** Six-month postoperative frontal view: 700 ml was aspirated from each breast, and the nipple-areola complex was elevated 5 cm on the right side and 4.5 cm on the left side. **b** Same patient as before: **b1** preoperative oblique view; **b2** 6-month postoperative oblique view

breast lift to a maximum of 1,200 ml from each breast for large breasts.

Postoperative mammograms are obtained at 1 year and 3 years after the operation. Evaluation of the clinical and radiological results is supervised by a senologist. Particular care is given to the evaluation of breast calcifications and to the long-term evolution of postoperative fibrosis [13].

The duration of the procedure and the amount of energy required to liquefy the excess fat may vary depending on the characteristics of the tissue encountered, the volume of the planned reduction, and the type of breast tissue. Purely fatty breast tissue is easier to treat than mixed glandular tissue, in which fat cells are smaller, stronger, and more dense. 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. The surgical planes, with good criss-cross tunneling and adequate undermining, are routinely followed, as planned in the preoperative drawings. Then the deeper planes are reached, and more time is needed in thicker areas. The infiltration of the tumescent solution in the breast area precedes the application of ultrasound; between 500 and 1,000 ml of solution is needed to obtain good tumescence of the region (Fig. 40.7, center and right).

If the procedure is performed while the patient is under general anesthesia, the typical Klein formulation can be changed slightly. The amount of lidocaine can be reduced to 200 mg in 1 l of solution for postoperative analgesia, or the anesthetic can be completely eliminated if the anesthesiologist prefers standard analgesics in the postoperative period.

Suction drainage is routinely used in the breast for at least 24 – 48 h. Elastic compression support (Topifoam; Inamed, Santa Barbara, CA) is applied for 7 – 10 days, and a brassiere completes the dressing. The dressing helps support the breast and the skin redraping in the immediate postoperative period.

Results are visible immediately after the operation. The skin envelope redrapes nicely and contours the new breast shape and mound. The skin appears soft and pliable; the treated breast tissue also is soft. The elevation of the nipple-areola complex, as a result of the skin contraction and the rotation of the breast mound, is immediately visible. The greatest amount of postoperative elevation of the nipple-areola complex was up to 5 cm (Figs. 40.8, 40.9).

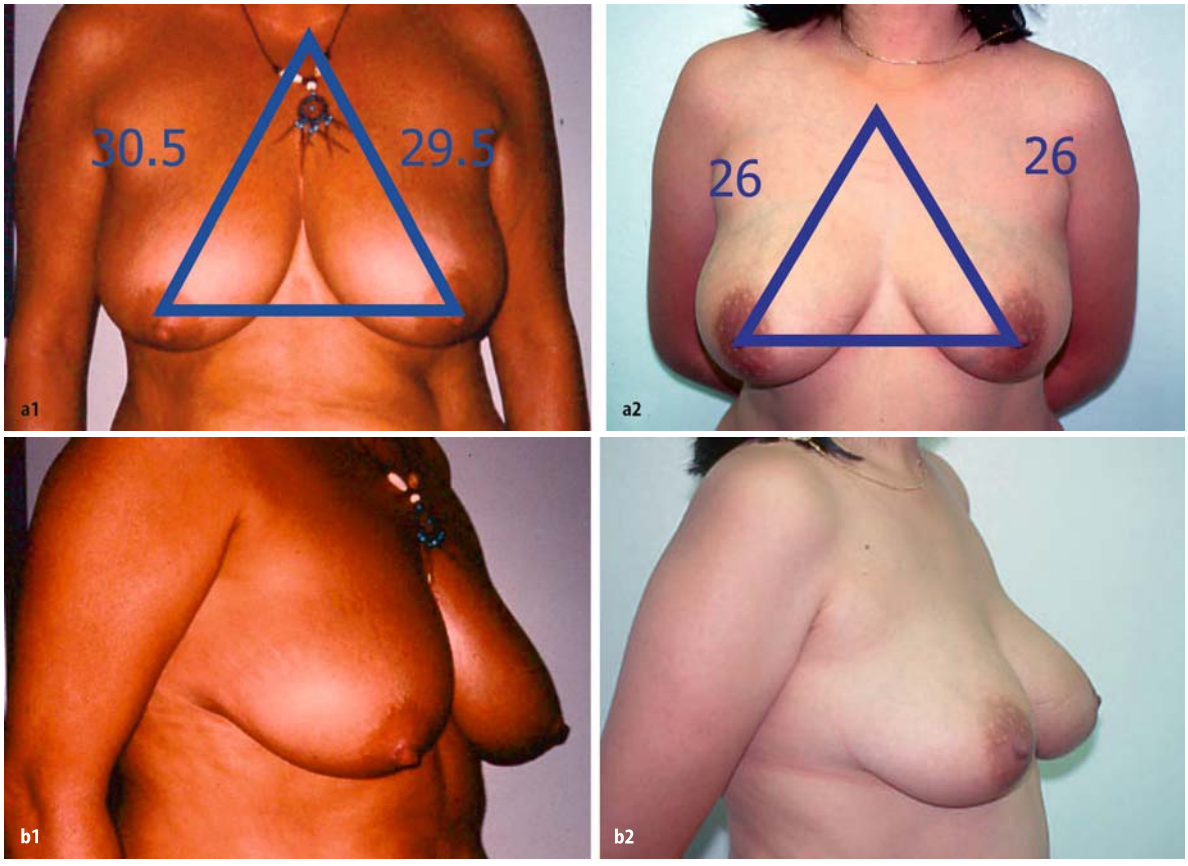

Fig. 40.9. a A 43-year-old patient with severe breast hypertrophy and fourth-degree ptosis: **a1** preoperative frontal view; **a2** 6-month postoperative frontal view; 900 ml was aspirated from each breast, and the nipple-areola complex was elevated 4.5 cm on the right side and 3.5 cm on the left side. **b** Same patient as before: **b1** preoperative oblique view; **b2** 6-month postoperative oblique view

40.4 Discussion

The ideal candidates for a breast reduction with ultrasound-assisted lipoplasty are patients with juvenile breast and patients with fatty or fibro-fatty breast with good skin tone and elasticity.

Preoperative evaluation of the patient is mandatory, including a mammographic study, a breast clinical history, and an evaluation of breast ptosis and the consistency of the breast parenchyma.

Breast reduction with ultrasound-assisted lipoplasty consists of progressive emulsification through the use of a solid titanium probe cannula, which transmits ultrasonic energy to target the fatty component of the breast tissue. Skin incisions are minimal and limited to a 1.5-cm incision at the inframammary fold and another at the axilla.

The modified tumescent solution is used to distend the breast area and induce severe vasoconstriction due to the use of adrenaline. Tumescent infiltration also allows the transmission of ultrasound energy to emulsify the fat cells. Normally, 20 – 30 min of ultrasound application, while preserving the central cone of the breast, including the nipple-areola complex, is enough to reduce the breast brassiere volume by two sizes. Ten minutes of ultrasound can produce 300/500 ml of pure fat emulsification, depending on the probe used.

Along with ultrasound-assisted lipoplasty to the fat layers, starting from the deeper layers and progressing to the more superficial ones, it is advisable to stimulate the superficial layers of the subcutaneous tissue of the upper and lower quadrants using a different angle pattern, as in a standard liposuction. This superficial stimulation with low-frequency ultrasound energy helps enhance the retraction of the breast skin and helps redrape the breast skin to the newly shaped and reduced mammary cone. The fibrosis that follows the dermic insult caused by the passage of the ultrasound probe is probably responsible for the great skin retraction that normally follows and contributes to correct breast ptosis. Up to 5 cm of nipple elevation is possible, if there is great volume reduction along with good stimulation of the subcutaneous layer of the entire area.

A large series of patients with mild to severe hypertrophy and ptosis have been treated in the last 7 years.

In the patients treated, no evidence of calcifications [16] caused by the surgical procedure was found at the 7-year follow-up. Essentially, increased fibrosis of the breast tissue was noticed in postoperative mammograms and is believed to be responsible for the new consistency, texture, and tone of the breasts and, according to the clinical results, the lift of the breast.

Ultrasonic energy can be used safely to emulsify fatty breast tissue and to reduce the total volume of hypertrophic breasts in selected patients [17, 18]. The ideal candidate is the juvenile breast, which normally results in fatty parenchyma, or the breast with postmenopausal involution parenchyma, both of which have good skin tone and elasticity. Ultrasound energy applied to fatty tissue has already been shown to be a selective technique [19]. The energy generated by the ultrasound device, and converted through a piezoelectric crystal transmitter, is administered through a solid titanium probe at different frequencies, depending on the thickness of the targeted tissue.

Fat is easily liquefied when a water-based solution is added to increase the fragility of the cell's adiposity. During the operation, along with general anesthesia or intravenous sedation, we use a wetting solution that is a variation of the well-known Klein tumescent solution.

The solution is composed of 1,000 ml of Ringer lactate and 1 ml (or one ampule) of pure adrenaline. No bicarbonate or lidocaine is used when breast reduction with ultrasound-assisted lipoplasty is performed with the patient under general anesthesia or intravenous sedation. If the operation is performed with the patient under local anesthesia, the modified Klein solution is prepared (1,000 ml of Ringer lactate, 0.75 – 1 g of lidocaine, and 1 ml of pure adrenaline) [20, 21].

Ultrasound-assisted lipoplasty in breast surgery is a relatively young chapter of this new technology. Zocchi [2 – 7] and Goes [1] pioneered the use of the ultrasound probe to dissolve and emulsify the fatty component of breast tissue. However, in the past, liposuction was first used by several authors as an adjunctive procedure in breast reduction. Since publication of the work of Illouz [22], Pitman and Teimourian [23], and Lejour [24, 25], many authors have suggested that liposuction could have a significant role in breast contouring. Later, other authors, such as Toledo and Matsudo [26] and Grazer [27], reported the aspiration of breast fat to reduce volume. Becker [20] and Courtiss [21] reported a few cases in which breast volume reduction was accomplished using a sharp cannula to suction glandular as well as fatty tissue. Most authors have concluded that it is advisable to suction only fat from the breast and to use blunt, not sharp, cannulas, which do not penetrate the parenchyma.

Initially, breast liposuction was used as a temporary measure in juvenile, fatty, hypertrophic breasts, until breast growth was complete and a more definitive operative procedure could be performed. More frequently, liposuction was performed to complete a standard open surgery breast reduction by defatting the axillary aspect of the breast in fatty patients. The selectivity of ultrasound-assisted lipoplasty was shown by Fischer et al. [19] and by Palmieri [28] in their studies. In addition, Scheflan and Tazi [29] introduced endoscopic evaluation of ultrasonically assisted liposculpturing.

Using an auxiliary endoscopic system and camera, they performed ultrasound-assisted lipoplasty using

criss-crossed tunnels and recorded the technique on videotape. An adjacent area was treated with standard liposuction. They compared the lipoplasty technique with standard liposuction, endoscopically assisted and monitored. Their results were as follows:

1. Standard liposuction appears to be a more aggressive technique, with mechanical destruction of the subcutaneous tissue, including the vessels, nerves, and supporting structures, despite the use of 2-mm-wide to 3-mm-wide blunt cannulas.
2. Ultrasound liposculpturing is a gentler, selective method that is aggressive only in the fatty compartments of the body; it spares the vessels, nerves, and elastic supporting fibers.

Alterations in the tissue as a result of ultrasound-assisted lipoplasty consist of a thickened dermal undersurface, markedly thickened vertical collagenous fibers, intact lymphatic vessels, and intact blood vessels. Scheflan and Tazi [29] hypothesized that the horizontal and vertical thickening and the shortening of the collagen in the dermis and ligamentous fibers are responsible for the remarkable skin tightening which 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 skin-tightening effect is of great value in breast surgery, where volume reduction has to be accomplished by skin redraping and recontouring of the breast shape.

40.5 Complications

Skin necrosis can occur using an incorrect approach to the technique, mostly trying to debulk the lateral and medial breast flaps by using ultrasound.

Fat necrosis with secondary tissue induration is a typical sequela of ultrasound surgery; when it is localized in small areas, it can be treated with massage or with corticosteroid local infiltration to soften the area. Loss of sensation is generally limited to the first 3 weeks after the operation; early recovery of sensation is explained by the fact that the central cone of the breast, which is mainly composed of pure parenchyma, is not touched during the operation. Skin sensation is recovered in a few weeks time.

Hematoma is another potential complication in the area of the infiltration, due to improper use of the infiltration needle (sharp needles instead of blunt needles). Hematoma has to be evacuated by the surgeon immediately after the operation.

Mastitis, an inflammatory response in the breast parenchyma as a result of the operation, can also be a complication. The authors prefer to operate on patients only during their nonmenstrual periods; only a minor inflammation response has been noted. When encountered, it is treated immediately with oral anti-inflammatory drugs and wide-spectrum antibiotics on a 3-day cycle; the inflammation subsides rapidly.

Seroma formation is a potential complication of every breast surgery and ultrasound-assisted lipoplasty technique. Regular application of suction drainage and breast compression for several days with a brassiere and foam pads have dramatically reduced this complication to nearly none.

40.6 Conclusions

Ultrasound-assisted lipoplasty for reduction of fatty breasts and fixation has been revealed to be a safe and good technique, when applied in selected patients and performed by a surgeon with expertise in ultrasound-assisted body contouring. Long-term mammographic studies have shown no alterations to the morphology of the breast parenchyma. The typical outcome is more dense breast tissue.

The selectivity of ultrasound, which emulsifies just the fat component of the breast parenchyma, makes it a technique of caution, as it spares the glandular tissue, the vascular network of the gland, breast sensation, and the potential for breast feeding. Breast-feeding and sensitivity tests have been reported in patients who have had the operation, and no alteration has been found at 4-year follow-up [30].

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