Reduction Mammoplasty: "The Piece of Art"

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45.1 Introduction

The female breast is one of the most attractive aesthetic areas in female anatomy. Representation of breasts in fine arts is best represented in Ingres erotic paint "Turkish Bath" (Fig. 45.1) and others. All paints are eloquent testimonies to the important role that feminine beauty and depiction of breasts play in societies. Our perception of what constitutes beautiful and sensuous breasts have not changed for the past 2,500 years. The size, shape, and symmetry of the breasts can have a dramatic effect on the women's well-being. Reduction mammaplasty is certainly one of the operations; plastic surgeons can significantly contribute to a woman's quality of life. Surgery has repeatedly shown high patient satisfaction rate.

Many women with excessively large breasts might suffer from poor self-esteem, altered self-image, and other psychological effects. In addition, women whose breasts are abnormally large relative to their body built are frequently limited in their choice of clothing and lifestyle. They may find it difficult to exercise, to play sports, and to participate in other daily activities. In short, a woman's breast size can affect her attitudes, career choices, and personal life in many ways.

Medical conditions like skin lacerations and intertrigo, chest tightness, chronic headaches as well as breast, neck, back, and shoulder pain are common presenting complaints of women with excessively large breasts. These symptoms are either eliminated or markedly improved by reduction mammaplasty. After surgery, many of these women enjoy a totally new outlook, cured from their medical complaints and pursue activities that were previously unavailable to them.

This chapter will review the anatomic basis for many of the breast reduction operations, summarize most of the literature, and discuss the senior author's (FSF) preferred technique on reduction mammaplasty.

45.2 History

Breast reduction surgery continues to evolve and is being refined constantly with a large number of procedures. Each presents particular advantages in terms of indications, vascular preservation, technique design, ease of realization, minimum scarring, maintenance of innervation, and long-term results.

As early as the sixth century AD, Paulus Aegineta described details of reduction mammaplasty for the correction of gynecomastia. Hans Schaller performed a reduction mammaplasty by breast amputation in 1561 [1]. Dieffenbach [2] was the first to perform a reduction mammaplasty in a female, leaving the scar in the inframammary fold. Thomas [3] and Guinard [4] emphasized the inframammary fold as an entrance site for the surgical correction of excessive breast tissue.

Most of the operations performed in the late 1800s and early 1900s aimed at correcting ptosis. Various types of skin and glandular excision were involved, all of which attached or suspended the breasts into a higher position on the chest wall, but without true nipple-areola complex (NAC) transposition. The concept

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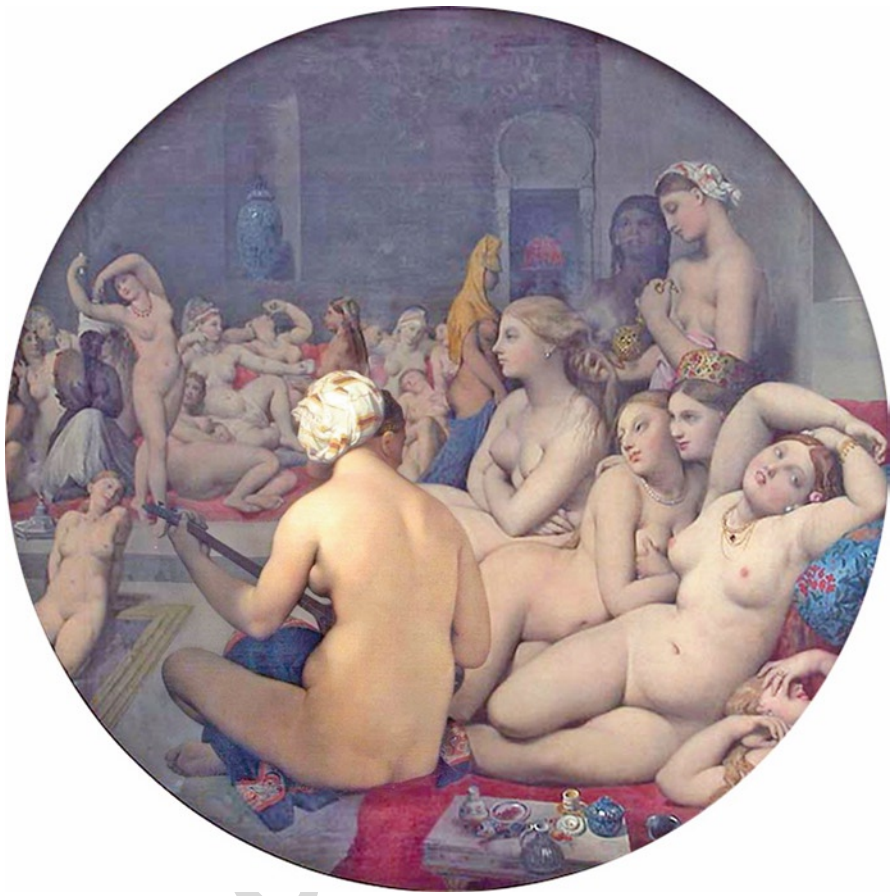


Fig. 45.1 The Turkish Bath painting by Ingres in 1862

of nipple-areola complex transposition was advanced between 1909 and 1925. Morestin in 1909 [5] was probably the first to transpose the nipple-areola, followed by Villandre, cited in 1925 and referring to patient whom he operated on in 1911 [6], and Lexer [7].

The next stage in the evolution of breast reduction surgery concentrated on the better understanding of the blood supply of the skin, mammary gland, and nipple-areola. The subdermal blood supply to the breast skin and gland was carefully considered.

In 1937, Schwarzman [8] recommended leaving a periareolar dermal ring to enhance arterial and venous blood supply to the nipple-areola. This maneuver improved viability of the nipple-areola complex, facilitated its transfer, and was a start for techniques involving deepithelialized nipple pedicle flaps.

The importance of preoperatively marking the incisions was emphasized by Bames in 1948 [9]. The following year, Aufricht [10] remarked that ultimate breast form is determined by the postsurgical "skin brassiere." Wise in 1956 [11] described a pattern for preoperatively marking the breast that produced accurate and reproducible resection of parenchymal tissue with minimal complications and satisfactory breast shape.

Subsequent refinements in breast reduction surgery evolved around pedicle designs to preserve vascularity and place the scars in more aesthetic sites. Various orientations of the breast dermal and parenchymal pedicles were described. Strombeck [12] described a horizontal dermal bipedicle flap that helped maintain innervation to the nipple-areola complex. McKissock [13] described a vertical bipedicle flap; Weiner [14], a superiorly based flap; Orlando and Guthrie [15], a superomedially based flap; and Courtiss and Goldwyn [16] and Georgiade [17] used inferiorly based flaps (Fig. 45.2).

Several authors since have described additional innervation to the breast, Marchac [18], Góes [19], Lejour [20], and Lassus [21], facilitating vertical and short-scar reduction techniques. Although some of these techniques were developed in the late 1960s and 1970s, it's only been in the last few years that they have gained widespread popularity.

45.3 Pathology

Massive breast enlargement or gigantomastia (juvenile virginal hypertrophy of the breast) was first described by Durston [22]. It is defined as yielding at least 1,800 g of tissue per side during reduction mammaplasty [23, 24]. It is characterized by massive enlargement of the breast tissue to enormous proportions, predominantly manifests in early puberty between 11 and 14 years of age and most often manifests with the first menses [23, 25].

Massive breast enlargement consists primarily of fibrous tissue and fat, while the glandular elements remain quite small (9). The pathophysiology of breast hypertrophy is thought to be an abnormal end-organ response to circulating estrogens [26–28]. Jabs et al. [29] showed normal levels of estrogen and the usual number of estrogen receptors in women with mammary hypertrophy, evidence of some women's hypersensitivity to the hormone.

Eliasen [30] noted changes consistent with atypical ductal hyperplasia in the surgical specimens obtained from five of nine young women who underwent reduction mammaplasty for hypertrophy, none of them showed any signs of breast carcinoma. This study suggests that ductal hyperplasia may also play a role in the

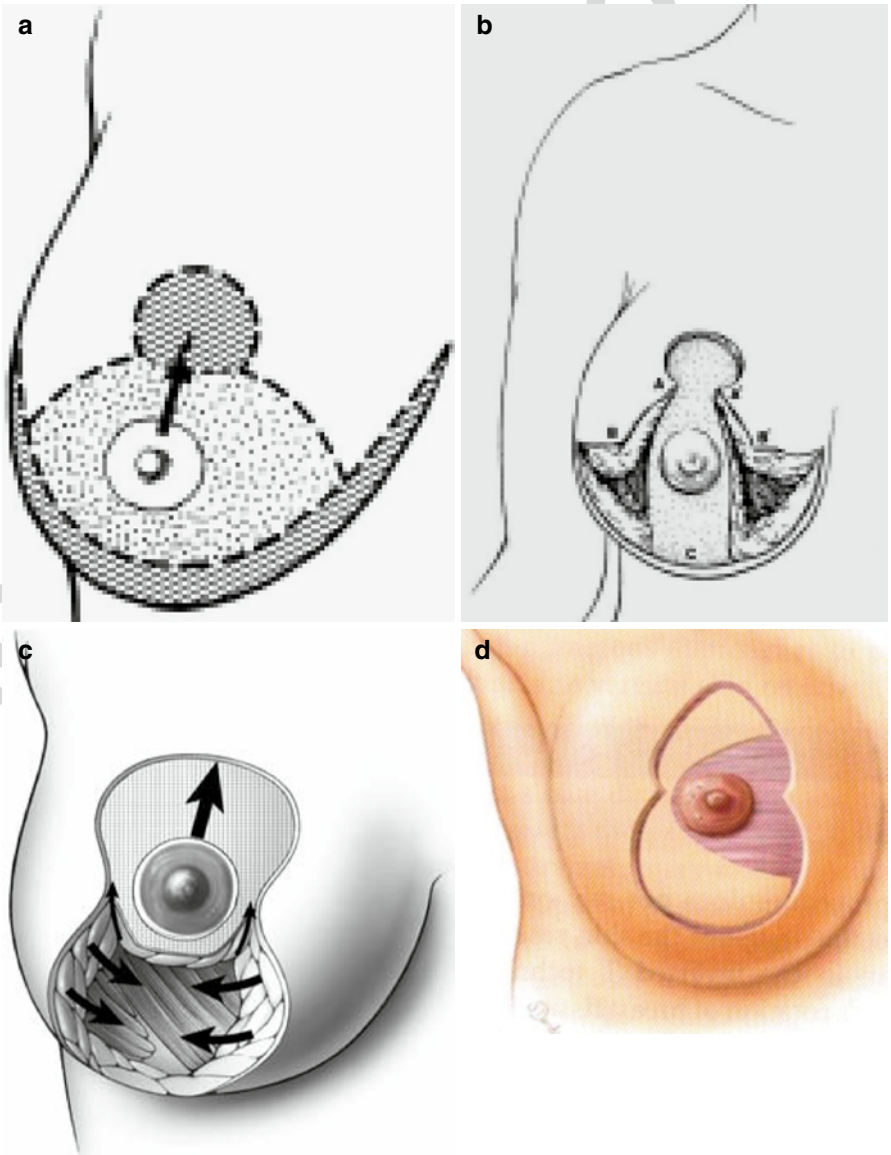
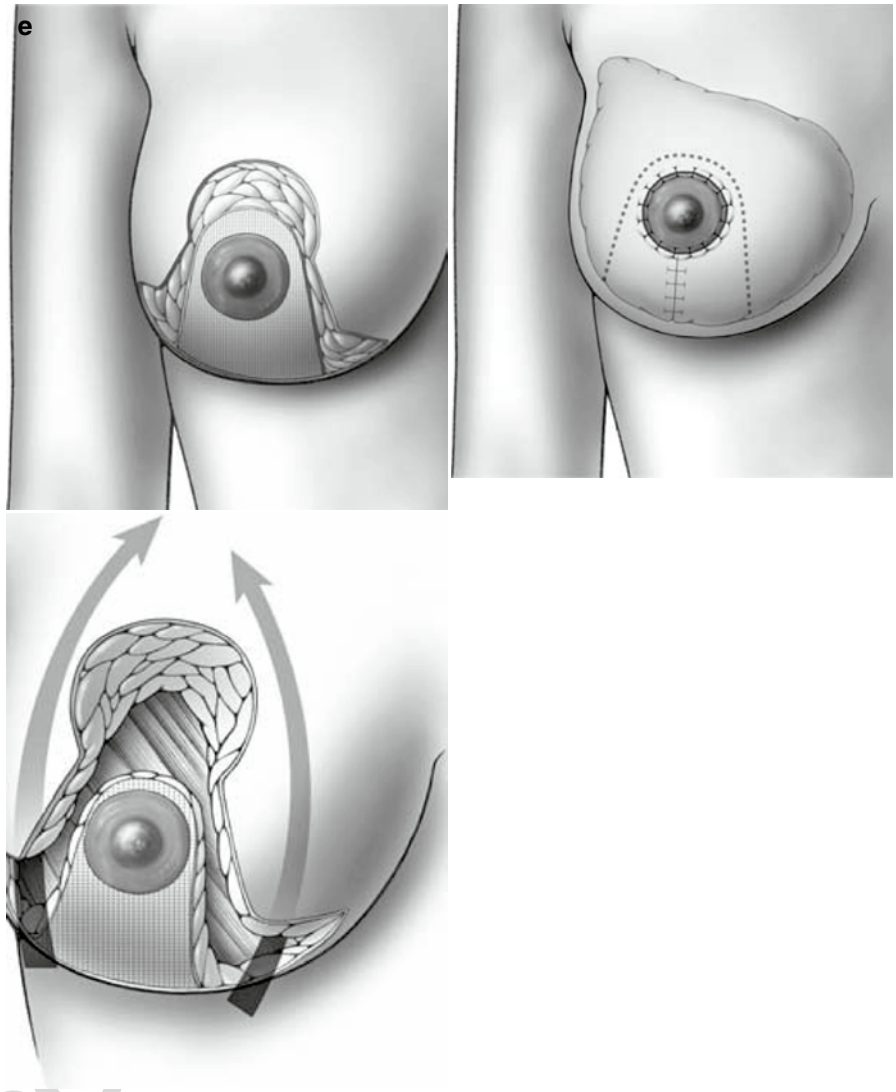


Fig. 45.2 Various orientations of the breast dermal and parenchymal pedicles. (**a**) Horizontal bipedicled flap. (**b**) Vertical bipedicle flap. (**c**) Superiorly based flap. (**d**) Superomedially based flap. (**e**) Inferiorly based flaps

Fig. 45.2 (continued)



etiology of breast hypertrophy. Kupfer et al. [31] reviewed the literature of juvenile breast hypertrophy and presented their experience in two patients, mother and daughter, which suggested to them a familial pattern to the disease.

45.4 Gigantomastia

The mainstay of treatment in gigantomastia is radical surgery. Free nipple grafting is frequently required to obtain an adequate reduction. Recurrence of gigantomastia is a recognized risk, particularly among pregnant women, and surgical reduction is the primary therapy for recurrence [23].

A hormone assay is not indicated, especially in a person who has normal secondary sex characteristics [23].Although early studies showed that hormone suppression was ineffective in the management of gynecomastia, Baker and associates [32] reported a successful experience with tamoxifen combined with reduction mammaplasty.

The differential diagnosis of unilateral massive breast hypertrophy in adolescent girls includes fibroadenoma, cystosarcoma phyllodes, virginal hypertrophy (unilateral), breast hamartoma, and trauma [23, 33, 34].

45.5 Indications for Surgery

Breast size that is out of proportion to body habitus has a profound effect on the musculoskeletal system. Many patients complain of neck and shoulder strain, headaches, breast pain, back pain, persistent rashes in the intertriginous areas, a heavy anterior chest, and occasionally, paresthesia of the ulnar side of the hand. These women tend to show poor posture, with deep shoulder grooving from bra straps, stretch marks, and rashes under the breast. In extreme cases, degenerative arthritis of the cervical and thoracic spine has been noted. Letterman and Schurter [35] discuss the anatomical basis for these signs and symptoms, and concur with others that reduction mammaplasty may be curative.

The psychological benefits of restoring proportion between a woman's breasts and her physique are difficult to quantify, but most surgeons believe they are considerable. Despite various studies of reduction mammaplasty showing favorable results [36–43], the surgical indications for reduction mammaplasty remain unclear and subject to different interpretations by third-party payers. Surgery is the only real option available to reduce the breast size. Hormonal therapy, as such, is ineffective. Supportive brassieres are temporary measures to relief symptoms by transferring the discomfort to other areas.

Netscher et al. [44] studied whether breast size alone was responsible for the presenting complaints of neck and back pain in patients seeking breast reduction. The authors found that symptomatic hypermastia is better defined by a constellation of symptoms rather than volume of tissue removed. There was no correlation between a woman's weight and symptoms associated with large breast size; overweight women had a different symptom complex than those with large breasts. The authors conclude that symptomatic hypermastia can be defined by a set of disease-specific physical and psychosocial symptoms which are not related to patient age or weight.

Kerrigan and coworkers [45, 46] investigated the quality of life of women with breast hypertrophy. The authors conclude that breast hypertrophy has a significant impact on women's quality of life. Symptoms are more important than breast volume in determining which women have the greater health burden.

In a third prospective study, the authors examined the effectiveness of surgical breast reduction in the relief of established symptoms of macromastia [47]. Analysis showed that 50% of operative subjects reported breast centered pain all or most of the time in the upper back, shoulders, neck, and lower back preoperatively. This number decreased to less than 10% postoperatively. Preoperatively, the study subjects had recorded significantly lower scores in all the health domains of the quality-of-life assessment tools and in the mental and physical component summary scores. Postoperatively, the operative subjects had higher average scores than the national norms in seven of the eight domains and had significant improvement from their preoperative evaluation in all eight domains ($P < 0.05$). The authors conclude that breast hypertrophy has a significant impact on women's health status and quality of life. Pain was found to be a prominent symptom in this disease process, and both pain and overall health status were considerably improved by reduction mammaplasty. They also concluded that patients with symptomatic hypermastia treated with conservative measures such as weight loss, special bras, and medications did not provide effective or permanent relief of symptoms.

The above-mentioned studies, in contrast with previously published data, are very well-designed, prospective analyses of randomized series that definitively demonstrate the disease process and medical indications for reduction mammaplasty, as well as validate the effectiveness of reduction surgery in the treatment of symptomatic hypermastia. The aim will be to disperse these data to third-party payers and have them adopt these guidelines as they are making determinations regarding breast reduction surgery coverage.

45.6 Aesthetic Concerns

There is great variation as regards heights, weights, body shapes, and physical conditions of women seeking reduction mammaplasty, no single breast dimension will serve all. Surgeons should individualize each patient's desires regarding ultimate breast size and shape in light of her age, physique, and surgical limitations. Although all candidates for reduction mammaplasty want to have their breasts made smaller, most do

not wish their breast size to be out of proportion to their build. Aufricht [10], Penn [48], and Berry [49] caution against trying to recreate a virginal appearing breast; rather, the goal of reduction should be a smaller but slightly pendulous, mature looking breast.

As famously said by Sir Harold Gillies, much that we do in plastic surgery involves a battle between beauty and blood supply. Over the years, the battle extended to include minimizing scars. Breast reduction is no different. The underlying principles of breast reduction and mastopexy surgery have evolved significantly in the past 20 years. Breast bottoming out occurs most frequently with inferior pedicle techniques in which much of the breast shape depends on skin tension. Other techniques incorporate additional parenchymal support without skin tension or skin shaping, and bottoming out can be controlled for excellent long-term results.

The multitude of different techniques and modifications with regard to pedicle choice, scar position and length, or breast shaping reflects the challenge for every plastic surgeon to achieve an aesthetic shape with long-term stability and with minimal scars in mammoplasty. This inspired the senior author (FSF) to describe his own breast reduction marking technique and develop a new surgical approach.

45.7 Author's (FSF) Preferred Technique

The problem of macromastia has been the object of the efforts of many plastic surgeons since late nineteenth century. In the USA alone, nearly 40,000 women undergo breast reduction each year [50].

For the senior author (FSF), breast reduction presents both artistic and technical challenges. The surgery aims to reduce the vertical and horizontal planes, shape the parenchyma, reposition the nipple-areola complex, and resect redundant skin. The surgery on paired organs has the added challenge of symmetry. The added effect of recumbence alters the shape and position of the breast. The classic breast shape, as we know it, exists in the erect posture. Much of the outcome of our work as plastic surgeons is determined by preoperative planning and designing. The availability of numerous marking techniques of breast reduction and mastopexy and the abundance of further modifications over the last decennia are clear indications that none of the approaches have proven to be ideal.

The majority aim is to achieve some degree of precision in determining the angle between the two vertical limbs. This ultimately affects the amount of the tissue resected and the postoperative shape. Few, if any, of such techniques have gained total popularity or acceptance by the plastic surgeons. The freehand marking technique is probably the most widely used technique. Devices such as template [11, 16, 51], [AU1] shaped wires, goniometers, and geometrical techniques have also been recommended [16, 52–56]. Some of these devices have stood the test of time; others have been modified or abandoned.

The free hand technique, being the most widely used, requires experience and practice in order to achieve the desired results. Multiple devices have been created to facilitate markings including templates, keyhole patterns, goniometers, etc. The standard pattern with a fixed angle of 110° between the two segments was further modified by McKissock [13] to allow for adjustment of the angle to the widely variable breast shapes. The Wise keyhole pattern marking is influenced by the surgeon's experience.

The standard patterns and devices are rigid methods that may achieve symmetrical markings, not necessarily symmetrical outcome. They do not account easily to preexisting breast asymmetry. Devices may also be not readily available in all hospitals. This factor could be a disadvantage to the surgeon who practices in more than one hospital.

The inherent difficulties of these techniques, the lack of flexibility, and the need to memorize different measures and mathematical calculations, on some occasions, made me alter the approach of my preoperative marking. Over the last 15 years, the author (FSF) has developed and evolved the Sitting, Oblique, and Supine (SOS) marking technique. This method is dependent on the natural breast fall and is aimed to guide on the appropriate angle between the two vertical limbs, each breast on its individual merits. It would be applicable in most breast reduction and mastopexy surgery; however, the author (FSF) used it largely in the inferior pedicle technique.

45.7.1 Preoperative Marking: The SOS Marking Technique

The patient is marked preoperatively in three positions.

1. Sitting (Fig. 45.3)

This position is adopted to mark the midline, midclavicular point (usually 7.5 cm from the sternal notch),

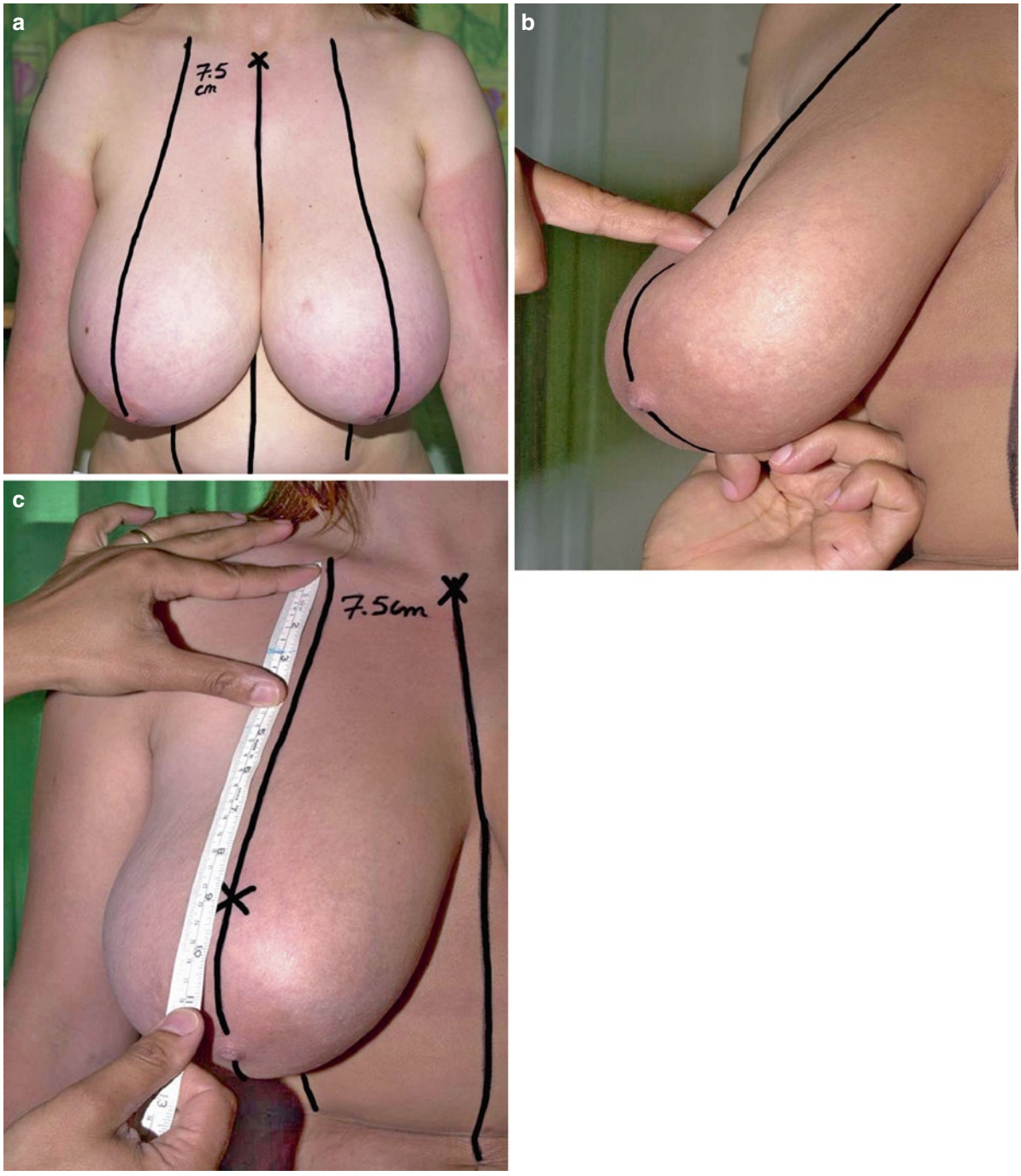


Fig. 45.3 Patient in sitting position. (**a**) Gentle pressure on the breast mound clearly defining the inframammary fold. (**b**) The breast meridian marked from the midclavicular point, usually 7.5 cm lateral to the sternal notch. (**c**) The superior limit of the vertical limb marked with reference to the inframammary fold

and the breast meridian. The breast meridian is marked as a straight line joining the midclavicular point to the current nipple-areola complex (NAC) extending down to the inframammary fold. The superior limit of the vertical limbs is then marked with reference to the inframammary fold. This marks the possible future position of the NAC. The distance from the midclavicular point to the superior limit of the vertical limbs is

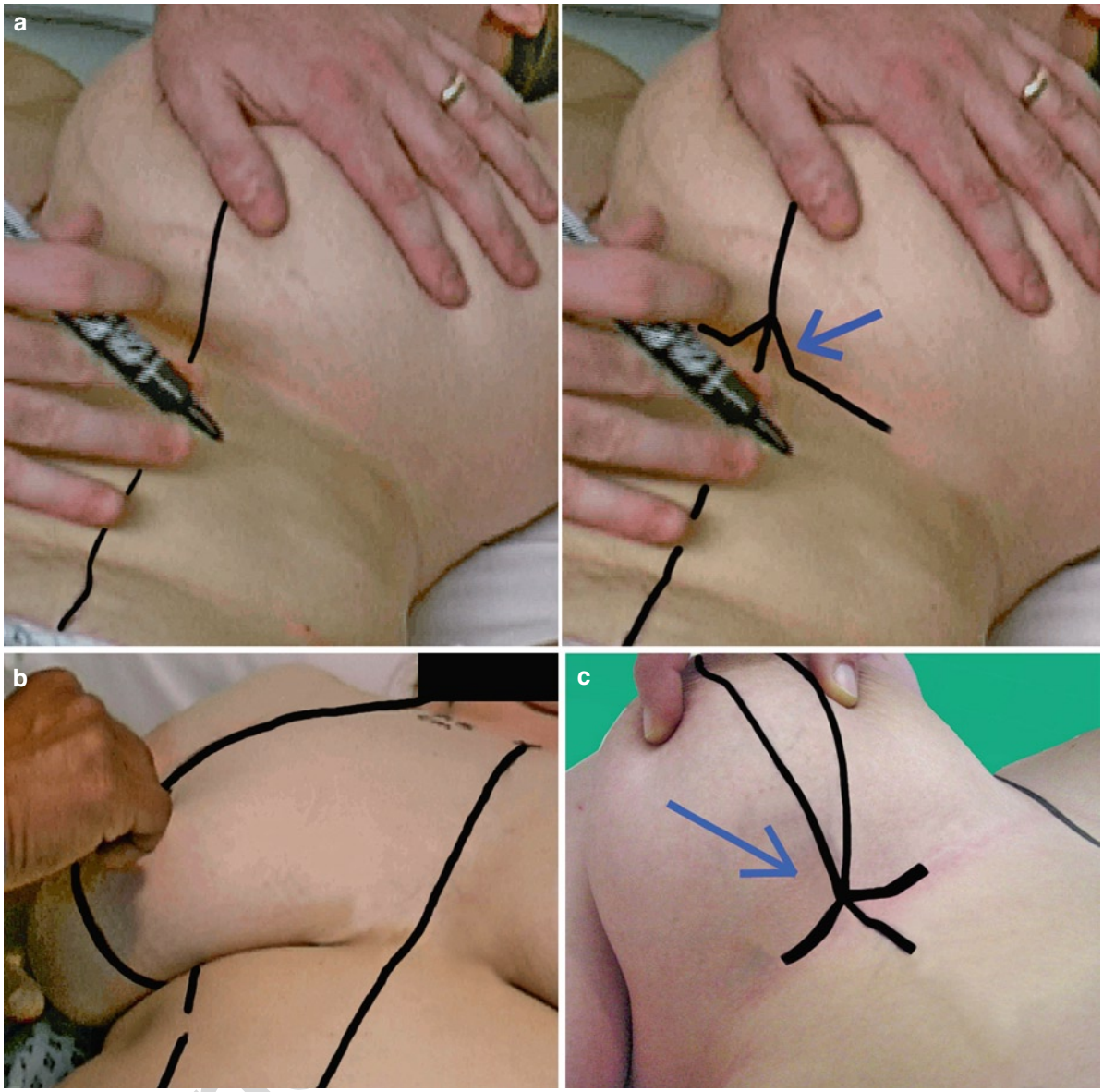


Fig. 45.4 Patient in the supine position. (**a**) Marking of the inframammary fold, *arrow* pointing to the dart. (**b**) Marking of the medial limb. (**c**) Marking of the medial limb completed

then measured, and the same measure is used to mark the contralateral NAC.

2. Supine (Fig. 45.4)

The supine position is used to mark the inframammary fold incision and the medial limb of the vertical markings. Whilst the patient is lying flat, the inframammary fold is marked, while applying very gentle pressure on the breast mound. Every effort should be made intraoperatively to minimize the length of the future inframammary scar, start with a short incision and extend as necessary, cut as you go approach. A "dart" coinciding with the breast meridian is marked along the inframammary incision line. This aids in reducing tension on the wound at the time of skin closure. While remaining in the supine position, the breast will naturally fall laterally. A straight line is drawn

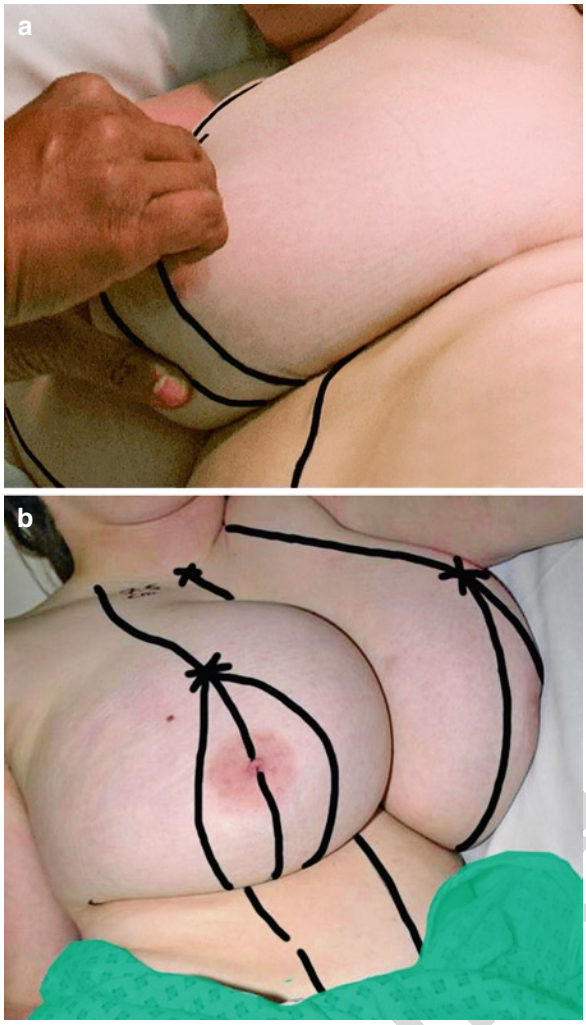


Fig. 45.5 Patient in the oblique position. (**a**) Right oblique position, marking the left lateral limb. (**b**) Left oblique position, right lateral limb marked

joining the superior limit of the vertical limbs to the dart. This will indicate the medial limb of the vertical limbs.

3. Oblique: Left and Right (Fig. 45.5).

The oblique position is mainly to mark the lateral limb of the vertical markings. The patient is marked in the left and right oblique position. In the left oblique position, the right breast will naturally adopt a medial position. A straight line is marked joining the superior limit of the vertical limb to the dart. This marks the lateral limb of the right breast. While in the right oblique position, the left breast will adopt a medial position. A straight line is marked joining the superior limit of the vertical limbs to the dart. This marks the lateral limb of the left breast.

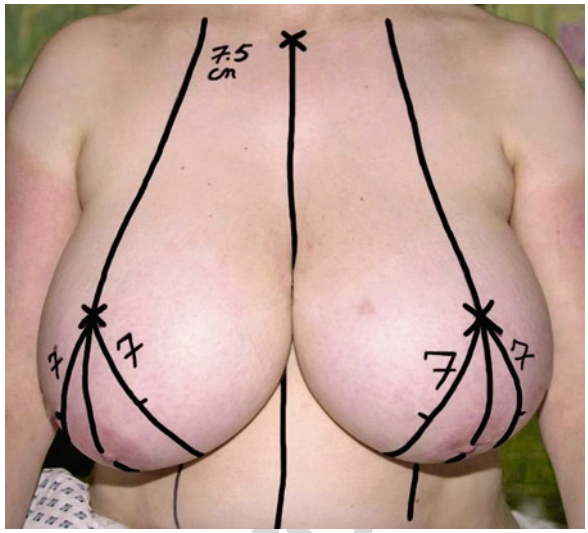


Fig. 45.6 Patient in sitting position marking the length of the vertical limbs

Finally, the patient is returned to the sitting position. The medial and lateral vertical limbs are measured at a length of 7 cm from the superior limit of the vertical limbs (Fig. 45.6).

The above are all the required preoperative markings. The author (FSF) now tends to join the vertical limbs to the medial and lateral ends of the inframammary marking intraoperatively. This is carried out in "a cut as you go" fashion aiming at avoiding dog ears and also minimizing the length of the inframammary scar. The new NAC is usually marked at the end of the procedure, after the resection is completed. The lower margin of the NAC is approximately 4–5 cm cephalad from the inframammary fold dart.

Over the years, the SOS marking has been found to be a versatile technique dependent on the natural breast fall. The breast is viewed as a dynamic organ requiring the individual analysis of each breast (Figs. 45.7–45.9). The natural fall of the breast spontaneously generates the desired angle between the vertical limbs, accounting for any existing asymmetries. Marking the patient in the supine position has the added advantage of clearly identifying the inframammary fold. Marking in the sitting position only, as referred to in other techniques, may present difficulty in defining the inframammary fold in large ptotic breasts. There are no specific

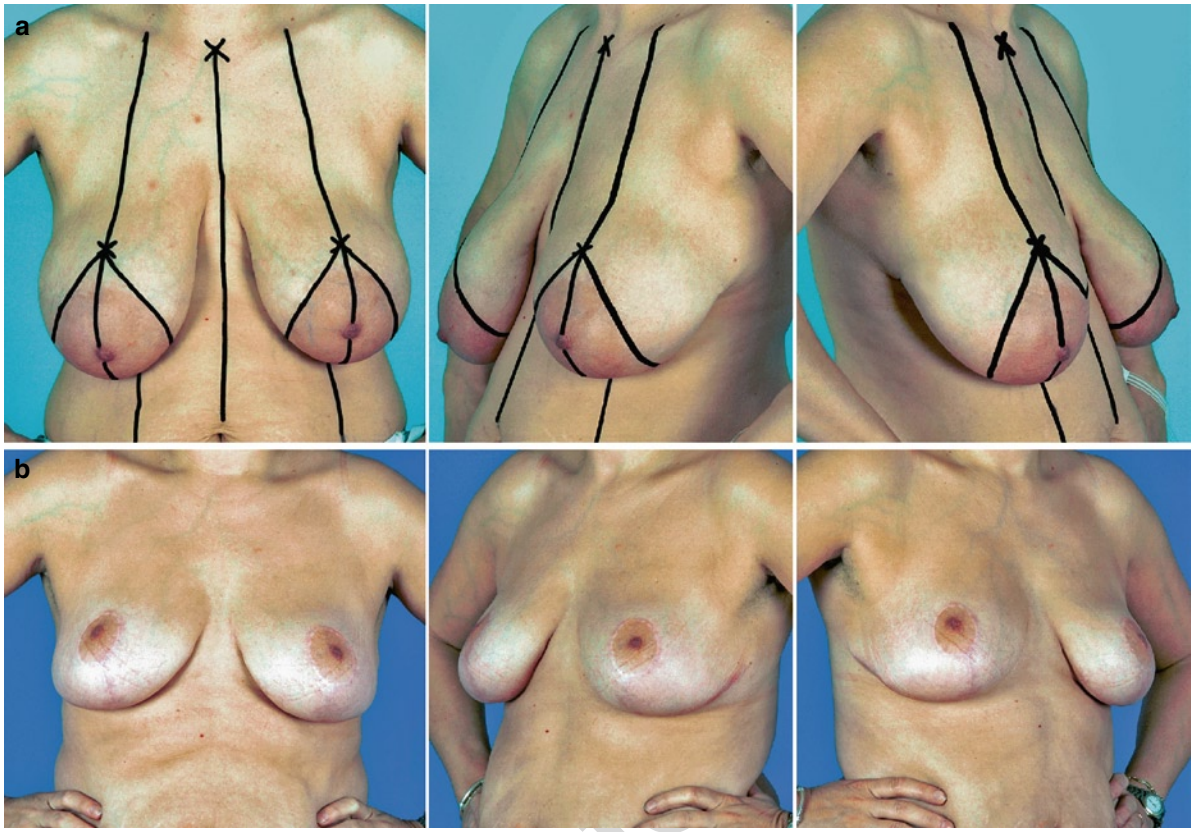


Fig. 45.7 (**a**) Preoperative. (**b**) Six months postoperative

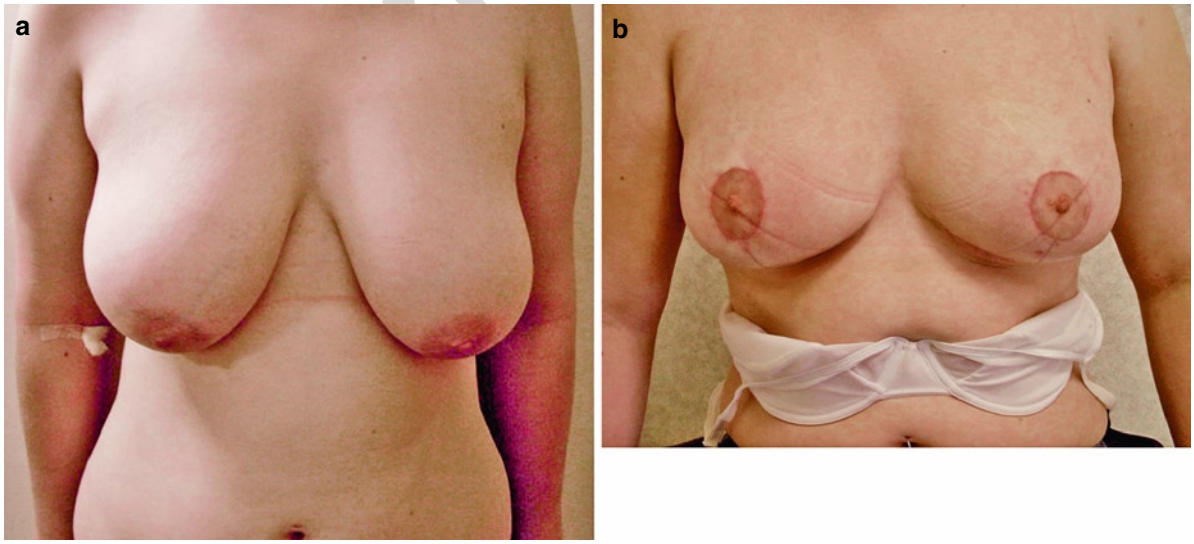


Fig. 45.8 (**a**) Preoperative. (**b**) Two weeks postoperative

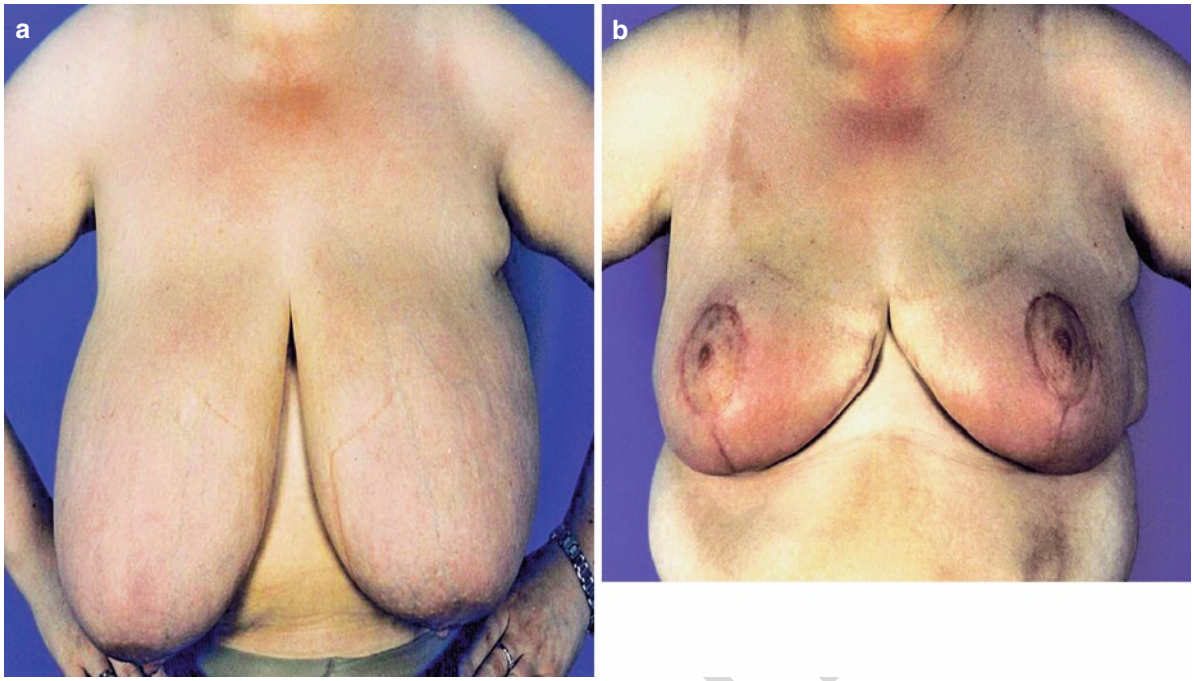


Fig. 45.9 (**a**) Preoperative. (**b**) Six months postoperative following resection of 1,800 g/side

devices required in this technique. There is no need to memorize any particular reference points apart from the three standard landmarks, the inframammary fold, the sternal notch, and the midclavicular point. There is minimal handling of the breast, hence minimizing human errors.

Undoubtedly, there is a learning curve for any new technique. The SOS in my view is relatively easy to learn by the beginners and easy to adopt by the experienced. It is readily available, not requiring major alterations to our current practice and account for the great diversities in the shape and size of the breasts.

45.7.2 Surgical Technique

Breast reduction is a constantly evolving surgery. For the author (FSF), the inferior pedicle with the inverted T-shaped scar stood the test of time. It is a versatile technique, suitable for the small and large reductions, gives flexibility in sitting the nipple-areola position, hence minimizing the risk of a too high nipple-areola complex. Over the years, as much as the author (FSF) has developed the technique in the preoperative marking, the surgical approach changed with particular emphasis on defined anatomical dissection planes, respecting and understanding the principles of the vascularity of the flaps. This has greatly reduced the postoperative complications with minimal revision rate. On those principles, the 3-plane dissection surgical approach was developed, and the author (FSF) has also been able to reduce the length of the inframammary scar to be slightly longer than the width of the pedicle, particularly in mastopexy and small reductions.

Preoperatively, the breasts are marked in the sitting, oblique, and supine positions, as previously described [57]. Intraoperatively, all the markings are scored (superficially incised) using a #10 blade and #15 blade for the nipple incision (Fig. 45.9). This is to avoid loss by rubbing off the markings.

A large swab is used as a tourniquet around the breast base (Fig. 45.10). This helps to stabilize the breast during the deepithelialization and early part of the dissection and reduces the intraoperative bleeding. The base of the pedicle is approximately 7 cm wide. The inferior pedicle is deepithelialized. On completion of deepithelialization, the medial and lateral flaps are raised using the 3-plane dissection modification.

Laterally, an avascular anatomical plane (mastectomy plane) is created and followed between the breast

Fig. 45.10 Scoring and incision of the nipple-areola complex. A large swab is used as a tourniquet around the breast base

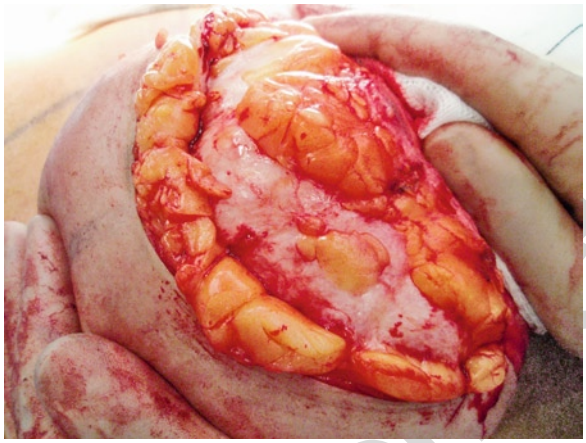


Fig. 45.11 Laterally, an avascular anatomical plane (mastectomy plane) is created

and subcutaneous tissue down to the pectoralis fascia. This plane is easier to locate laterally and follow towards the breast meridian (Fig. 45.11). This yields a lateral flap of adequate and uniform thickness, reducing the risk of postoperative fat necrosis and avoids bulky lateral flaps. This plane is more uniform and easier to follow compared to the literature-recommended 1-cm thickness of the flaps.

Medially, the breast is dissected in a perpendicular fashion down to pectoralis fascia. This ensures medial fullness and helps to create a breast cleavage. The tourniquet at the base of the breast is removed at this stage. Centrally, a plane joining the medial and lateral portions is created.

Once dissection is complete following the planes, the thickness of the lateral, central, and medial flaps should be optimal with no need to excise tissue from any of the flaps. The main bulk of the breast tissue will be on the pedicle. Reduction or excision can then be performed under direct vision, from the bulky pedicle, avoiding any potential danger of compromising the vascularity of the pedicle. At this stage, a marker suture is inserted at the 12 o'clock position of the nipple. This aids in allocating the nipple and its correct orientation when determining its position after closure of the rest of the incisions. Under no circumstances should pull be exerted on this marker suture, to avoid compromising the blood supply. The breast skin flaps are undermined medially as far as the sternocostal junction and superiorly as far as the clavicle. The author (FSF) tends to avoid lateral undermining, to limit the lateral fullness. One vacuum drain is inserted per side and sutured lateral to the inframammary incision. The T-junction is sutured to the apex of the dart along the inframammary incision, a few millimeters above the inframammary fold thereby reducing tension. The flaps are sutured as a composite unit including the subcutaneous fat and the dermis to avoid degloving the skin from the underlying subcutaneous fat (Fig. 45.12). These modifications reduce the risk of skin necrosis and wound dehiscence at the T-junction. Monocryl, 3/0, is used as a deep subcutaneous suture and 4/0 Monocryl subcuticular. Generally speaking, suturing should start from the medial and lateral sides of the inframammary incision towards the breast meridian. This helps to reduce the risk of dog ears.

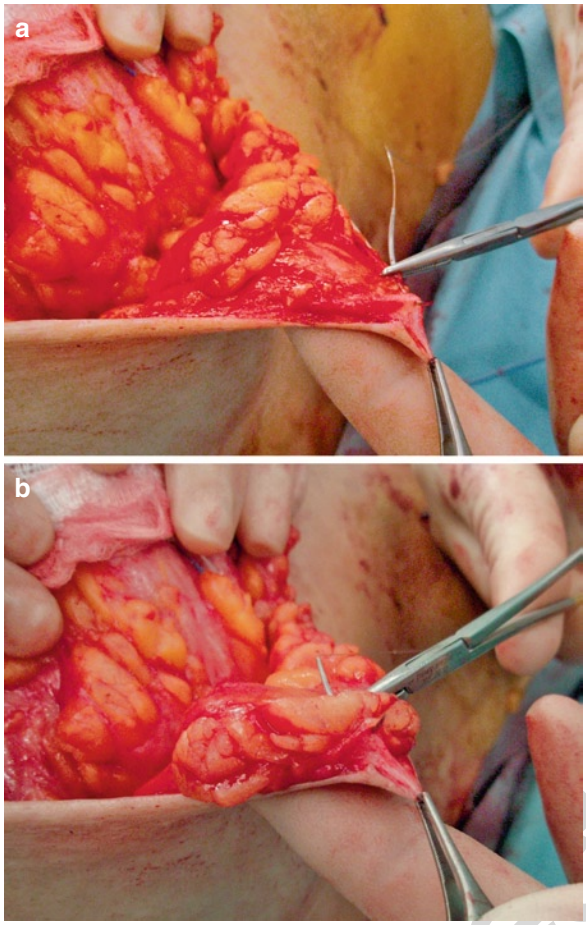


Fig. 45.12 (**a**) Inappropriate suturing that may result in T-junction breakdown as a result of degloving the skin from the underlying fat. (**b**) The recommended suturing at the T-junction, as composite flaps

Once all the incisions are sutured, 4–5 cm is measured from the dart along the vertical limb of the scar. This presents the base of the future nipple-areola complex. The nipple-areola complex is approximately 4 cm in diameter. Once this is marked, the disk of skin and underlying subcutaneous fat is excised, the previous nipple suture mark is followed, and the nipple is delivered in its new position. Monocryl, 4/0, is used for both the deep suturing and the subcuticular for the nipple-areola complex.

Half-inch suture strips are used to support the suture lines; a Mepore dressing is then applied. Finally, a layer of Microfoam is applied as a supportive dressing, cross your heart style. The dressings are reduced down to Steri-Strips 1 week later. Two weeks postoperative, all the dressings are removed.

45.7.3 Complications

The above approach has demonstrated a very low complication rate over the years. Retrospectively, review of 125 patients was performed. The age range was between 18 and 68 years, with a mean age of 34. The BMI range was between 21 and 35. This included both smokers and nonsmokers. The mean resection weight was 539 g per breast (range, 255–1,600 g).

The overall complication rate including nipple necrosis, hematoma, seroma, dog ears, wound dehiscence, fat necrosis, delayed wound healing/wound dehiscence at T-junction, hypertrophic scarring, and further surgical revision was less than 10%. The combination of the preoperative marking technique and the refinement of the surgical approach have provided me with a successful recipe and an excellent tool in the utilization of the inferior pedicle in all types of reduction and mastopexy, accommodating well in existing asymmetry and reducing the commonly known postoperative complications.

The revision rate over the years has been kept to a minimal. The intraoperative surgical modifications demonstrated a lower complication rate compared to other published data. The flaps are dissected in a fashion that follows anatomical planes. The mastectomy plane followed laterally and the perpendicular plane medially down to pectoralis fascia, help to reduce the risks of fat necrosis, enhances medial fullness, and reduces lateral fullness that could result from thick uneven flaps. The dart along the inframammary incision together with the composite suturing technique helps to reduce tension on the suture line and maintains the vascularity of the apices of the flaps as one unit. The reliability of the approach is supported by the relatively low complication rate compared to other published data.

The overall complication rate was shown to be less than 10%, compared to the literature-reported rates ranging from 13.6%, described by Bolger et al. in 1987 [58], to 50%, described by both Dabbah et al. [39] and Davis et al. in 1995 [41]. A recent paper by Hunter and Ceydeli in 2006 [59] reports a complication rate of 23.7%.

Dissections that follow the anatomical plane, including the lateral mastectomy plane flaps together with medial thick flaps down to pectoralis fascia, result in more uniform flaps that have less likelihood of fat necrosis. This is combined with the wound closure of

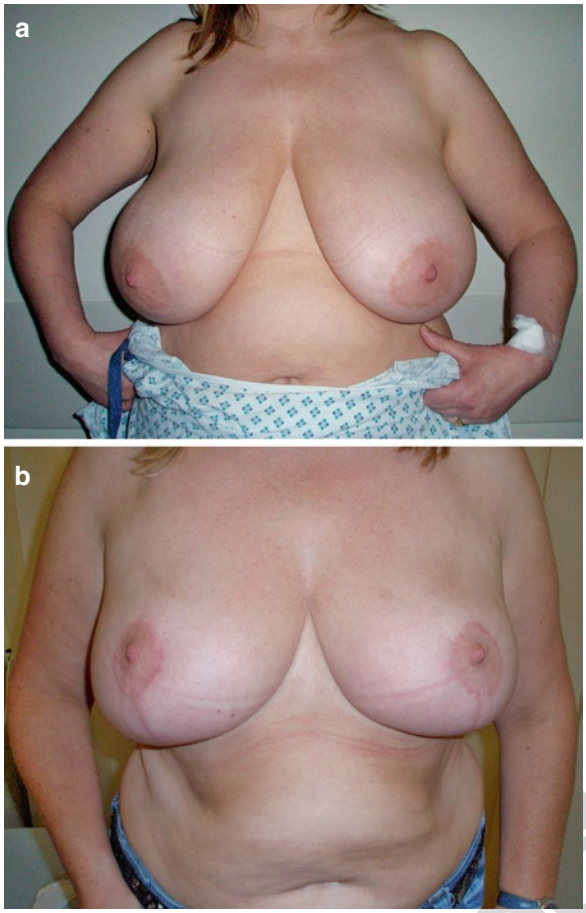


Fig. 45.13 (**a**) Preoperative. (**b**) Five months after surgery

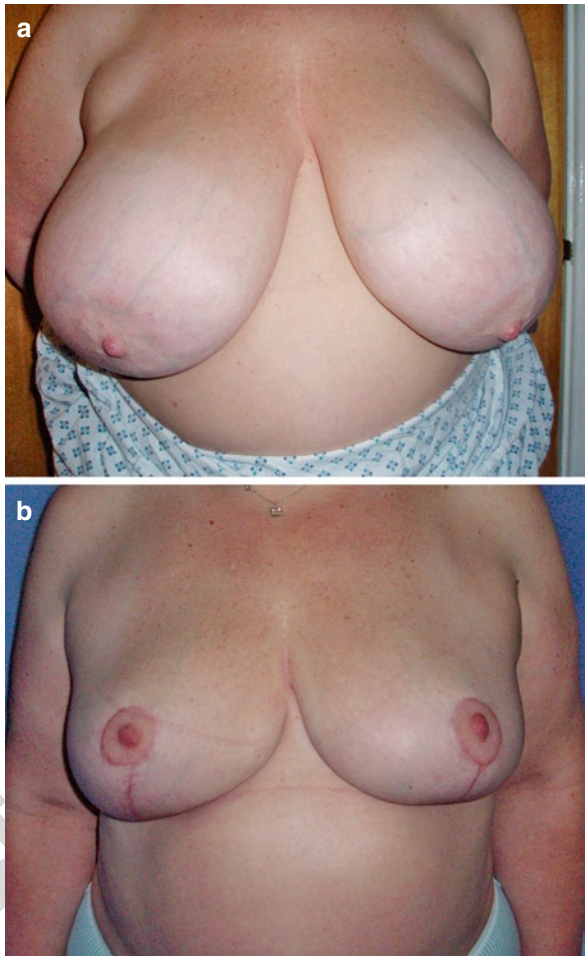


Fig. 45.14 (**a**) Preoperative. (**b**) Twelve weeks after surgery

the skin flaps as a composite unit, maintains the vascularity of the skin flaps, and avoids the potential degloving of the epidermis and dermis from the underlying subcutaneous tissue. This reduces the morbidity of such a common procedure and improve aesthetic outcome (Figs. 45.13–45.15).

45.8 Breast Size After Reduction Mammoplasty

Regnault [60] states that the amount of tissue that is to be removed during reduction mammaplasty depends on the ratio of breast girth to chest girth. Chest girth is determined first and equals the circumference of the chest measured under the arms. Breast girth is measured across the nipples and should encompass the fullest part of the breasts. If breast girth exceeds chest girth by 1 in., cup size is an A; 2 in., B; 3 in., C; 4 in., D; and 5 in., DD. He offers a rule-of-thumb for how much tissue will have to be resected to attain the desired breast size (Table 45.1).

These figures should be taken only as a rough estimate when formulating the surgical plan. Surgical experience and different techniques will have much more influence on final breast size than the resection guidelines.

45.9 Complications of Breast Reduction

General complications of reduction mammaplasty include hematoma, fat necrosis, infection, poor wound healing particularly at the T-junction with partial or complete disruption of the suture line, hypertrophic scarring, breast asymmetry, under or over reduction, persistent pain, and change in breast shape over time. Reduction mammaplasty might affect:

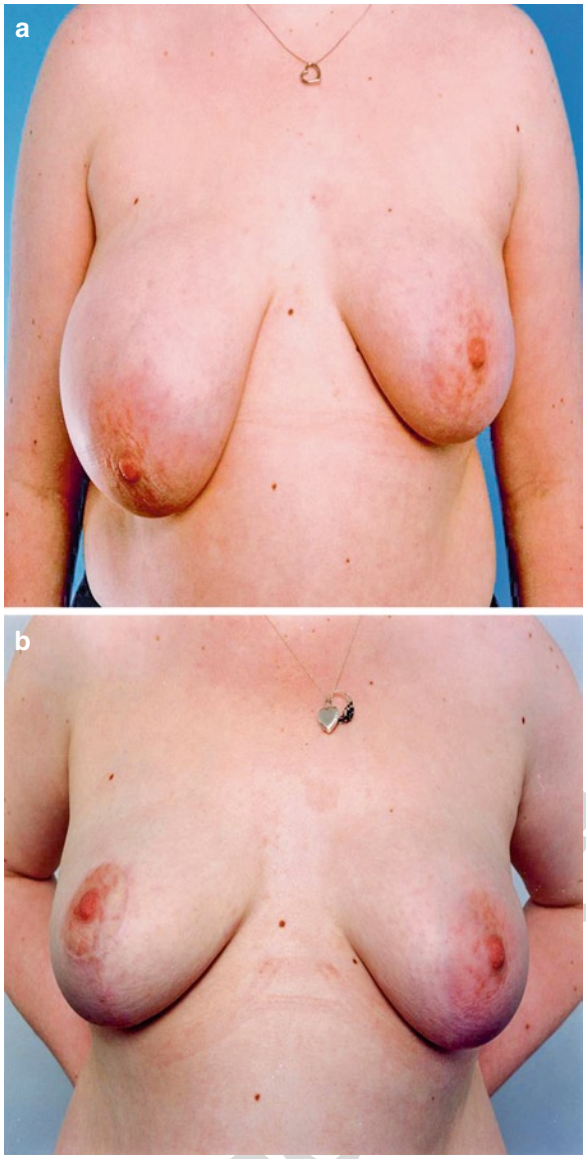


Fig. 45.15 (**a**) Preoperative patient with enlarged ptotic right breast. (**b**) After surgery

Table 45.1 Rule-of-thumb for how much tissue will have to be resected to attain the desired breast size

Chest circumference in inches reduction	For each cup size remove (g)
32–34	100
36–38	200
42–44	300
44–46	400

45.9.1 Vascularity of the Nipple and Areola

The complications of reduction mammaplasty are related primarily to insufficient vascularity of either the skin flaps or the pedicle on which the nipple-areola complex is based. Confirmation of adequate nipple perfusion is usually based on clinical exam and can be ascertained by laser Doppler flowmetry (LDF) and fluorescein flowmetry.

Hallock [61] evaluated patients undergoing breast reduction and compared the quantitative laser Doppler flowmetry with clinical examination. He measured perfusion of identical spots on the areola preoperatively and immediately after inset of the nipple-areola complex into its new position. He concluded that if the post transfer blood flow was thought to be less than 50% of the preoperative value, the pedicle should be explored. The author emphasizes that laser Doppler flowmetry can be a helpful adjunct to clinical tests of perfusion, particularly in darkly pigmented areolas.

Roth et al. [62] studied absolute Doppler values of nipple perfusion before and after reduction mammaplasty. Nipple perfusion immediately postoperative averaged 4.8 mL/min/100 g in patients who had no complications of surgery. In patients who had minor complications or gross necrosis, the nipple perfusion value was 1.4 and 0.8, respectively. Values in the range of 1.0–2.0 mL/100 g indicate marginal perfusion. Values <1.0 signify inadequate perfusion and warrant suture removal or consideration for exploration or free nipple grafting. The author recommends the laser Doppler for monitoring nipple-areolar perfusion in large reductions and particularly in dark-skinned patients who are difficult to evaluate clinically.

Perbeck et al. [63] used laser Doppler flowmetry and fluorescein flowmetry (FF) to evaluate viability of the nipple-areola complexes in undergoing reduction mammaplasty. By LDF, there was a 2.5× increase in circulation to the skin over preoperative levels after deepithelialization. When epinephrine was injected, the circulatory increase was only 1.5× the preoperative level.

Tracy and associates [64] used laser Doppler flowmetry to assess the blood supply of various types of pedicles undergoing reduction mammaplasty. In the immediate postoperative period, areolar perfusion declined by 23% (Skoog technique), by 18% (central pedicle technique), and by 21% (inferior pedicle technique). Two weeks after breast reduction, LDF values were 12% below baseline (Skoog technique), 2% above baseline (central pedicle), and 44% below

baseline (inferior pedicle). While this is an interesting study, they are technique dependent with varying success in different surgeons' hands.

45.9.2 Nipple Sensation

Loss of sensation to the nipple is a well-known complication of reduction mammaplasty. Townsend [65] finds only eight of 46 breasts had no return of sensation following nipple grafting which varies from 2 to 12 months.

Slezak and Dellon [66] documented lower sensory thresholds in the nipple, areola, and periareolar skin of women who had gigantomastia (D-cup or greater) compared with the same parameters in small-breasted women. The authors postulate that this may be related either to increased surface area of large breasts with a constant number of nerve fibers, or the result of a stretching intercostal nerves caused by the breast enlargement. Patients underwent breast reduction by McKissock technique and amputation with free nipple graft. Thirteen patients were evaluated perioperatively using vibrometers and Semmes–Weinstein testing. Nine patients available for follow-up, six had better sensation, two were less sensitive, and nipple sensation was unchanged in one. In the amputation group, some sensory loss was noted early postoperatively, but it improved with time.

Gonzalez et al. [67] quantified nipple-areolar sensation pre and postoperative using Semmes–Weinstein pressure threshold testing. They adopted the central parenchymal pedicle technique or a laterally based inferior pedicle technique. Overall, nipple sensitivity was lost in 9.5% of breasts, and they correlated with increasing breast size and corresponding amount of resection, as when <440 g per breast was resected, nipple sensation was retained 100% of the time.

Temple and Hurst [68] studied 45 women undergoing inferior pedicle breast reduction. Pressure threshold measurements were taken preoperatively and at 2 and 6 weeks, postoperatively. They noted significant improvement at 2–6 weeks. Only 2% of breasts had nipple numbness at 6 weeks.

Hamdi et al. [69, 70] looked at breast sensation after superior pedicle versus inferior pedicle mammaplasty. The cadaveric study was designed to quantify the nerve branches preserved in the pedicles during reduction surgery. They found slightly more branches in inferior pedicles compared with superior pedicles. Anterior and lateral branches of the second through fourth intercostal nerves were found in both groups and became more superficial near the areola. The authors conclude that careful deepithelialization of the pedicle is a must to keep the superficial nerves intact near the areolar border.

Hamdi et al. [70] analyzed breast sensation after superior versus inferior pedicle mammaplasty. They showed decreased nipple sensibility in both groups which was documented at 3 months. The breast skin had better sensation after superior pedicle techniques, while the areola had slightly better sensation after inferior pedicle techniques. No patient had a completely insensible NAC at 6 months.

Greuse [71] prospectively assessed breast sensitivity after Lejour's vertical mammaplasty (with superior pedicle). Assessments were done preoperatively and 3, 6, and 12 months postoperatively using Semmes–Weinstein monofilaments (constant pressure threshold), heated and cooled metal probes (for hot and cold perception), calipers (for static and moving two-point discrimination tests), and a Biotensiometer (to measure the vibration threshold). Their study was divided into two subgroups: Group I had sternal notch to nipple less than 29 cm and less than 500 g of tissue removed; group II had sternal notch to nipple greater than 29 cm and more than 500 g of tissue resected. In group I, there was an initial postoperative decline in sensitivity, although eventually returned to their normal level. In group II, although sensitivity to temperature and vibration diminished on the nipple-areola, patients did not complain of decrease in breast sensation.

45.9.3 Breast-feeding

Aboudib [72] compared the late results of reduction mammaplasty by the Pitanguy technique in 39 patients who did not become pregnant after surgery (group A) and 11 patients who did (group B). There were no significant differences between the groups in terms of weight gain, breast volume, or breast ptosis. Nine women in group B (91%) reported normal lactation and breast-feeding. The other two women reported decreased milk secretion and did not nurse.

Marshall et al. [73] studied breast-feeding in women after reduction mammaplasty. The patients'

abilities to nurse were recorded for up to 3 months after delivery, 93% wished to breast-feed, and on discharge, 73% were doing so. After 3 months, the number had dropped to 27%. All babies except one born of a mastopexy patient required complementary feeds. In the control population of nonreduced patients, 82% were breast-feeding on discharge from the hospital and 54% were still breast-feeding after 3 months. Seven percent of babies were able to feed entirely from the breast without complementary feedings. Although, no single operation was clearly superior in avoiding transection of the lactiferous ducts, the author recommends leaving all functional breast tissue attached to the nipple in a physiologic manner whenever possible.

Harris et al. [74] examined breast-feeding ability and behavior in reduction mammaplasty patients using inferior pedicle technique. The authors surveyed 68 women who had breast reduction, 29% (20) had become pregnant after surgery. All of them lactated, seven (35%) nursed their infants for at least 2 months, nine (45%) nursed for up to 2 weeks, and the other four did not attempt breast-feeding because of insufficient milk production.

Brzozowski et al. [75] examined 78 women who had children after their breast reduction using inferior pedicle technique. He found that 41 (52.6%) did not attempt to breast-feed, 14 (17.9%) were unsuccessful, 15 (19.2%) breast-fed exclusively, and eight (10.3%) breast-fed with formula supplementation. Postpartum breast engorgement and milk production was experienced by 31 of the 41 patients who did not attempt to breast-feed. The authors conclude that breast-feeding is possible post-reduction mammaplasty, and that the percentage of patients who successfully do so is comparable to the proportion in the general population. As part of the informed consent process, these data should be reviewed with patients of childbearing age before reduction surgery.

45.9.4 Interference with Cancer Screening

Because of the extensive dissection in reduction mammaplasty, some authors have expressed concern about the possibility that postoperative fibrosis and scarring may interfere with breast cancer detection.

Beer et al. [76] retrospectively assessed their ability to diagnose breast tumors after reduction. Ultrasound was unreliable and they recommend mammograms 3 months postoperative to establish a baseline from which to track postsurgical changes. They also mentioned that excisional biopsy should be done if there is any doubt about the diagnosis suggested by the imaging modalities.

Titley et al. [77] analyzed histologic findings in reduction mammaplasty specimens. The retrospective study included 295 reduced breasts. They noticed 25.6% were abnormal, although no premalignancy or overt cancer was identified. By questionnaire, the authors determined that 89% of British plastic surgeons "routinely sent breast reduction specimens for pathologic study [and] 42% had seen at least one case of breast cancer reported from this tissue." They recommend routine histopathologic study of reduction mammaplasty specimens in all patients over 40 and in younger patients when risk factors for breast cancer are present or the tissue appears grossly abnormal at surgery. Mammography was also recommended for patients 50–64 years old.

Özmen et al. [78] reviewed 274 breast specimens revealing three breast carcinomas (1.1%). The authors comment that this is higher than previously reported rates for incidental carcinomas in breast reduction specimens. Their recommendations are as follows:

1. Perform a thorough physical examination in all patients preoperatively and mammography in those over 35 years old.
2. Order intraoperative frozen sections of any suspicious areas.
3. Send all reduction specimens for pathologic examination.
4. Accurately mark specimen location.
5. Have the pathologist perform histologic examination as if it were a breast cancer specimen.

Mandrekas et al. [79] described the clinical and radiologic features of fat necrosis after breast reduction surgery. They mentioned that the use of electrocautery during mammaplasty may trigger necrotic changes in breast fat, which are difficult to differentiate from breast carcinoma. Surgical resection with scalpel may lessen this problem.

At the present time, most plastic surgeons continue to send all reduction specimens for histopathologic diagnosis. Specimens should be marked accurately as to medial, central, and lateral quadrants to help the pathologist localize the lesion, if found. Preoperative mammography is to be performed according to the

recommendations for breast cancer screening issued by the American Cancer Society in 1997. These include:

1. Breast self-exam every month for women age 20 and over.
2. Clinical breast exam every 3 years for women age 20–40.
3. Clinical breast exam and mammography every year for women 40 and older.

Analysis of the complications associated with different techniques may provide a clue to their relative success. At the same time, it is very difficult to compare the outcome of different techniques for reduction mammaplasty, as the variables of patient age, weight, body build, breast size, degree of reduction achieved, skin elasticity, distance of transposition of the NAC, and other patients variables.

Dabbah et al. [39] studied 185 women after reduction mammaplasty. Preoperatively, the most common complaints were shoulder grooving, back pain, shoulder pain, and neck pain. Average patient age was 40 years. The average amount of breast tissue removed was 855 g per breast. Postoperatively, 97% of their patients had improvement of symptoms and 59% were asymptomatic. Infection and fat necrosis occurred in 22%, necrosis of the nipple-areola in 4%, and unsatisfactory scars in 4%. Overall, 95% of patients were happy or very happy with the results of surgery, and 98% would recommend reduction mammaplasty to a friend.

Maxwell Davis et al. [41] reviewed 406 women who had bilateral reduction mammaplasty. Mean patient age at surgery was 38 years and average reduction was 676 g per breast. The inferior pedicle technique was used in 85% and a Strombeck mammaplasty was done in 15%. Postoperative complications occurred in 53% (215 women). Altered nipple sensation was reported in 25%, loss of nipple-areola complex in 6%, wound healing problems in 19%, bleeding from incisions in 18%, infection required antibiotics in 12%, and additional surgery was required in 5% of patients. Overall, 87% of patients were satisfied with their results. Of the 13% who were not satisfied, 18% had unacceptable scars, 9% felt their breasts were too large, 9% felt their breasts were too small, 8% had breast asymmetry, and 9% had breast contour deformities.

Woods et al. [80] compared the Maliniac, Skoog, Dufourmentel-Mouly, and McKissock mammaplasties. They found that complication rate was higher with the Maliniac and Skoog procedures, whereas McKissock's technique had the fewest postoperative problems.

Samdal et al. [81] documented the value of infiltrating dilute epinephrine for the control of intraoperative bleeding. Blood loss was reduced by more than 50% when compared with the non infiltrated side. Epinephrine injection was associated with no instance of flap compromise or postoperative bleeding.

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[AU3]

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Author Queries

Chapter No.: 45

Queries	Details Required	Author's Response
AU1	This sentence has been slightly modified for clarity. Please check that the meaning is still correct, and amend if necessary.	
AU2	Please check if edit to the sentence starting "Dissections that follow...." is OK.	
AU3	References 41 and 59 were found to be similar. Hence, we have deleted the repeated reference and renumbered the rest. Please confirm if the change made is okay.	