Vertical Mammaplasty

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Summary: Current criticisms regarding vertical mammaplasty include problems with poor immediate postoperative appearance, nipple-areola complex malposition, and excessive lower pole length. These problems can be avoided by proper patient selection, by utilizing correct concepts of skin design, and by observing correct glandular resection and closure concepts. Vertical mammaplasty also can result in other problems, such as hypertrophic circumareolar scars and lower pole deformities, including notching, boxy shape, infra-areolar depression, and flatness. These problems are also largely avoidable by using correct technique.

Several basic concepts described previously have not proven necessary to achieve good results. Abandoning some of these principles has contributed to the ability to establish an aesthetically ideal breast shape intraoperatively as well as to a decrease in morbidity. This includes eliminating liposuction as a major integral component of the procedure, eliminating suturing the gland to the pectoralis muscle, not undermining the lower pole skin, and avoiding overly wide skin resection and tight wound closure that produces significant lower pole distortion in the early postoperative period.

An important concept that has proven reliable is to use a "closed" design that does not predetermine the areolar opening whenever circumstances permit. When this is not possible, a modification that utilizes the smallest possible circumference as an open design is better than a large "mosque." These alternatives allow greater flexibility in determining final nipple position and also reduce the risk of hypertrophic circumareolar scars.

Important glandular resection concepts include creating pillars that are attached to both the skin and the chest wall; making them of adequate dimension to avoid postoperative lower pole shape problems, such as flattening; resecting closer to the skin lateral to the pillars to avoid a boxy breast shape; and using a drain both to assist in accurately determining the endpoint of resection and to avoid postoperative seromas.

Key closure concepts include approximation of the superior surfaces of the pillars at their base to maintain vertical height and thereby prevent lower pole flattening; approximation of the inferior surfaces of the pillars to the base of the breast to prevent notching; and proper management of the vertical incision by restricting the purse-string suture effect to only the inferior portion of the incision, where there may be skin excess present.

Inclusion of these concepts leads to predictable and improved aesthetic results in vertical mammaplasty. This allows full realization of the purported advantages of vertical mammaplasty and allows this method to be utilized with a level of confidence similar to that seen with inverted-T techniques. (*Plast. Reconstr. Surg.* 115: 1179, 2005.)

Vertical mammaplasty is an appealing technique because it promises fewer scars, narrowing of the wide breast, improved projection, and stable long-term shape when compared with the inverted-T techniques. Several authors

From the Division of Plastic Surgery, Weill-Cornell University Medical College. Received for publication October 8, 2003; revised September 13, 2004.

Presented at the Annual Meeting of the American Society for Aesthetic Plastic Surgery, in Boston, Massachusetts, May 17 to 21, 2003.

DOI: 10.1097/01.PRS.0000156335.92606.2A

have reported vertical techniques that are conceptually similar but vary in some details. Issues that differ among previous descriptions include the role of liposuction (integral or incidental), pedicle design (superior or medial), and whether or not to undermine the lower pole skin, imbricate the lower pole, or elevate the parenchyma by suture to the pectoralis major muscle.[1–8]

Vertical mammaplasty is quite different from inverted-T techniques in both design and execution.[9–20] It is inherently more intuitive and requires a certain amount of experience before a surgeon becomes proficient. The immediate postoperative results with traditional teaching in vertical mammaplasty have significantly compromised aesthetics, which are presumed to routinely "settle out" favorably over time. The technique also may have a potential for a higher revision rate primarily because there is less control over the skin envelope compared with that in inverted-T techniques. A certain amount of reluctance to adopt vertical mammaplasty is also due to the high degree of patient satisfaction with the versatile and comparatively simple inverted-T methods. All of these factors have resulted in slow adoption of this technique by the practicing community.

Certain long-term aesthetic problems can result from vertical mammaplasty, including malposition of the nipple-areola complex, areolar shape irregularities, hypertrophic circumareolar scars, excessive lower pole length, lower pole shape abnormalities (infra-areolar depression, flattening, notching, or boxy shape), and lower pole redundancy (dog-ear). Inadequate volume reduction can also occur both because less skin envelope reduction is possible compared with inverted-T methods and because more volume must be retained to fill out the larger skin envelope to achieve optimal projection. Understanding certain concepts and adopting modifications of previous descriptions of the technique can prevent these problems and also eliminate the greatly compromised intraoperative and early postoperative aesthetics that until now have been a reluctantly accepted and unavoidable aspect of the vertical mammaplasty technique. Results become more predictable and consistent, achieving the promise of superior projection, significant narrowing of the breasts, and stable long-term shape when compared with inverted-T methods. The indications for vertical mammaplasty can be progressively extended to increasing degrees of ptosis and breast size as experience increases using the technical concepts described herein.

Patients and Methods

This is a retrospective study of patients who had either a breast reduction or a mastopexy performed between May of 1998 and December of 2003. During this period 134 patients underwent vertical mammaplasty, 51 underwent inverted-T reduction, and six had breast reductions by other methods that were not the focus of this study. All charts in the vertical mammaplasty group were reviewed to document the amount of tissue removed and the length of the follow-up period, and to both quantify and characterize the types of postoperative surgical and aesthetic problems encountered.

Procedure Indications

It is easier to achieve consistent high-quality aesthetic results utilizing vertical mammaplasty when this method is applied to mastopexy and small or moderate size reductions (<800 g per side), although larger reductions can be undertaken with vascularized nipple transposition if the degree of ptosis is not extreme.[21] The long vertical limbs created in very large reductions predispose to aesthetic problems such as nipple-areola malposition (too high), excessive lower pole length, and problematic dog-ear formation. Complications are also more common.[22] Inverted-T methods are aesthetically far more predictable, particularly in the case of very large reductions, because generous skin excision is possible in both the horizontal and vertical dimensions.[23] This permits adequate reduction of the skin envelope without causing shape problems that are difficult to manage. Many of the limitations inherent in vertical mammaplasty design can be mitigated with increased operator experience, but this method is indeed less versatile than the inverted-T technique as resection volumes increase. Therefore an important factor in avoiding compromised aesthetic results in vertical mammaplasty is intelligent patient selection, particularly when the surgeon is first becoming acquainted with the technique. It is best to start with small volumes or small degrees of ptosis and gradually increase one variable or the other. Inverted-T methods should be favored for more extreme cases (large volume with grade III ptosis). The boundary between the

two techniques in terms of applicability can be extended with continued experience, but not all patients are best suited for vertical mammaplasty.

SKIN INCISION DESIGN

Both superior and medial pedicles can be used successfully in vertical mammaplasty. This report focuses on the use of a superior pedicle technique for the majority of patients, with a superior-medial pedicle variant used for those patients who either have stiff tissues or require a longer nipple transposition distance.

Vertical mammaplasty skin incision design begins by placing a mark at the inframammary crease in line with the vertical breast meridian that extends through the nipple. The new nipple position is then marked on the anterior breast generally at a level no higher than that of the existing inframammary crease. It is important to appreciate that closure of the splayed vertical limbs will automatically raise the selected nipple position slightly higher than marked (Figs. 1 and 2). In addition, the vertical mammaplasty technique has an innate tendency to produce a long lower pole. Even slight superior malposition of the nipple-areola complex will exacerbate the perception of excess lower pole length. For these reasons, the new nipple position is best planned slightly lower than the design guidelines would suggest. It is even better if selection of the nipple position can be deferred until late in the procedure, after the vertical limbs are closed and the patient is viewed sitting up. The ideal location for the nipple-areola complex can be most accurately determined in this setting.

The vertical incision component of the skin design is drawn next (Fig. 3). Manual displacement of the breast medially and then laterally (both with slight upward rotation) is used to determine the location of the two vertical limbs.[6,7] The vertical limbs converge and meet at the bottom of the breast at a point ranging from 1 to 3 cm above the existing inframammary crease, depending on the size of the breast. A distance of 1 cm would be appropriate for either a mastopexy or a minimal reduction, with the distance increasing to as much as 3 cm for a patient with large breasts in whom a reduction of 800 g or more is planned. The vertical limbs should be drawn with a curve as they descend in their inferior portion to meet at the bottom of the design. Making straight lines as they converge (i.e., more of a "V" than a "U") removes less skin in this area. This can result in a boxy lower pole shape.

The opening for the areola in vertical mammaplasty traditionally has been determined by freehand drawing of a "mosque" shape that has an approximately 16-cm length to the line.[6,7] This method, in which the final areolar opening is predetermined by the initial skin design, is termed an open design. This method has inherent limitations that can contribute to nipple-areola malposition, irregular areolar shape, and wide or hypertrophic circumareolar scars. Nipple-areola malposition (either too high or too low) can result from imprecise rendering of the areolar opening. The open design does

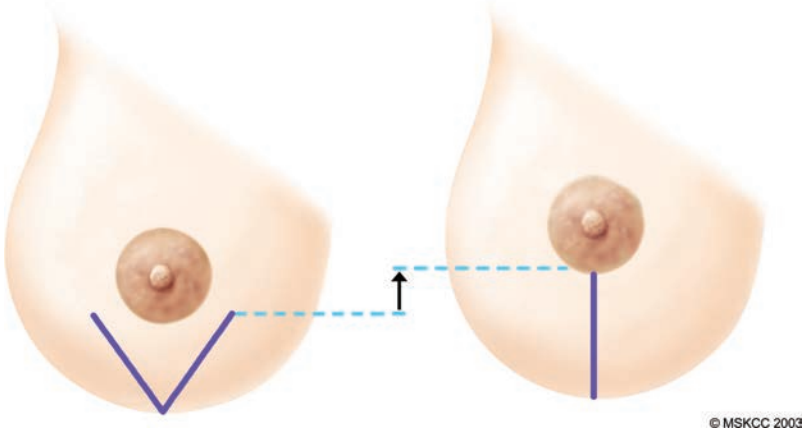

FIG. 1. (*Left*) The vertical limbs are shown drawn with a typical angle of divergence. (*Right*) Limbs of the same length, when approximated, automatically raise the nipple position as the splay angle between them is closed. Clinically, this elevation is more subtle but nevertheless is a factor in planning the position of the new nipple.

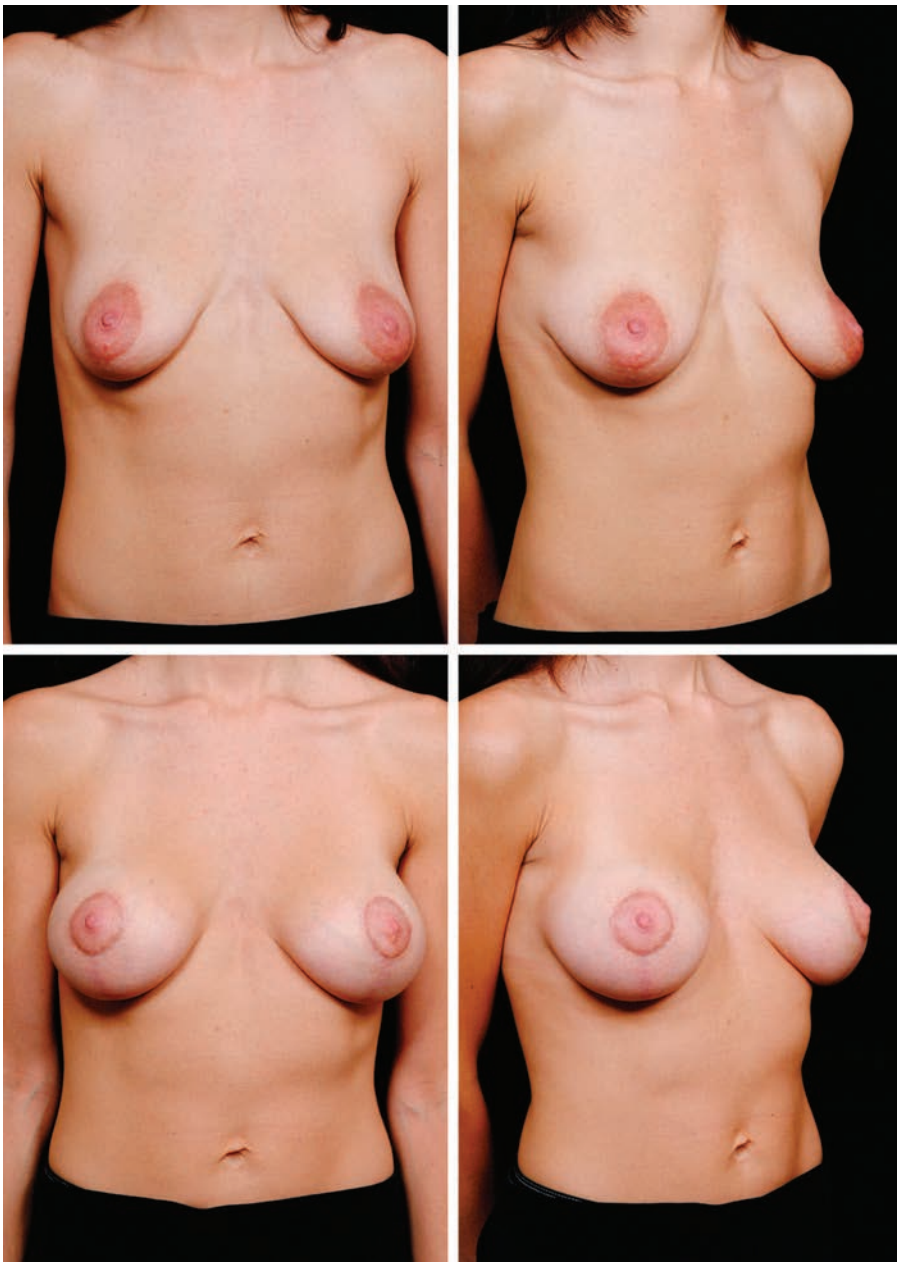

FIG. 2. Vertical augmentation-mastopexy. (*Above*) Preoperative views of a patient with postpartum atrophy; the skin is both loose and thin. Augmentation through a periareolar incision was combined with a vertical mastopexy to achieve optimal shape and remove some of the lax skin. (*Below*) In the postoperative views, note the subtle hyperpigmented lesion above the right areola at approximately 2 o'clock and how the position of this lesion has not changed postoperatively relative to the areola. This confirms that the areola was not raised higher than its preoperative position by intent, although it nevertheless appears slightly higher than desired in the postoperative views. This is due to the automatic nipple position lifting and lower pole lengthening that occur when the splayed vertical incisions are approximated together to form the final vertical closure.

FIG. 3. Skin incision design. (*Above, left*) The breast is lifted to show that the breast meridian has been marked at the inframammary crease. The new nipple position is seen as a dot above the areola at a level corresponding to the inframammary crease, just as is done with inverted-T methods. (*Above, right*) The breast is displaced medially to simulate the desired postoperative lower pole contour, and the vertical incision is marked along a line that connects the new nipple position reference dot above to the inframammary crease meridian mark below. (*Below, left*) The breast is then displaced laterally and the second vertical limb is marked in a similar fashion. (*Below, right*) The breast is then lifted and the vertical limbs are connected with curving lines to a point positioned along the meridian but above the inframammary crease. In this case of a small reduction, the lowermost point of the design is only about 1 cm above the crease. The remainder of the skin incision design superiorly is drawn as either an open or a closed areolar design (see text).

FIG. 4. Modified open areolar skin design. Instead of the more traditional rendering of a large mosque-like opening to determine future areola position and shape, the smallest possible opening for the areola is drawn. Trial closure later will yield a small-diameter nipple-areola complex that can then be adjusted for optimal position and diameter.

not allow the nipple-areola position to be shifted up or down later in the procedure, when such a maneuver might otherwise improve the result. In addition, an overly wide areolar skin design may result in excessive tension on the circumareolar closure, with the development of scar hypertrophy postoperatively. This has been observed to occur in some breasts even when the total length of the line determining the areolar circumference is within the suggested length of 16 cm.

These potential problems can all be avoided by modifying the drawing of the areolar opening when an open design method is used. After the vertical limbs are drawn as described, the smallest possible areolar opening is designed by drawing the shortest possible curved line that will skirt the existing areola and connect the superior endpoints of the vertical limbs (Fig. 4). When the initial incision closure following resection is performed, this areolar opening will be quite small, sometimes as small as 3 cm in diameter. The areola is sutured into place with a temporary running suture, and the patient is placed in a sitting position. A larger circle can then be drawn to create a perfectly round areola of the desired diameter. The final position of the opening can also be shifted up or down during this process to optimally position the nipple height in relation to the lower pole dimensions and overall breast shape (Fig. 5). After a new circle of the appropriate diameter is cut out, the areola is permanently inset. This modification of the traditional open design will avoid the problems enumerated above.

An alternative method of skin design that deals effectively with areolar opening issues can be termed the closed method, because an areolar opening is not included in the preoperative skin design.[24] This method is possible when the degree of preoperative ptosis is suf-

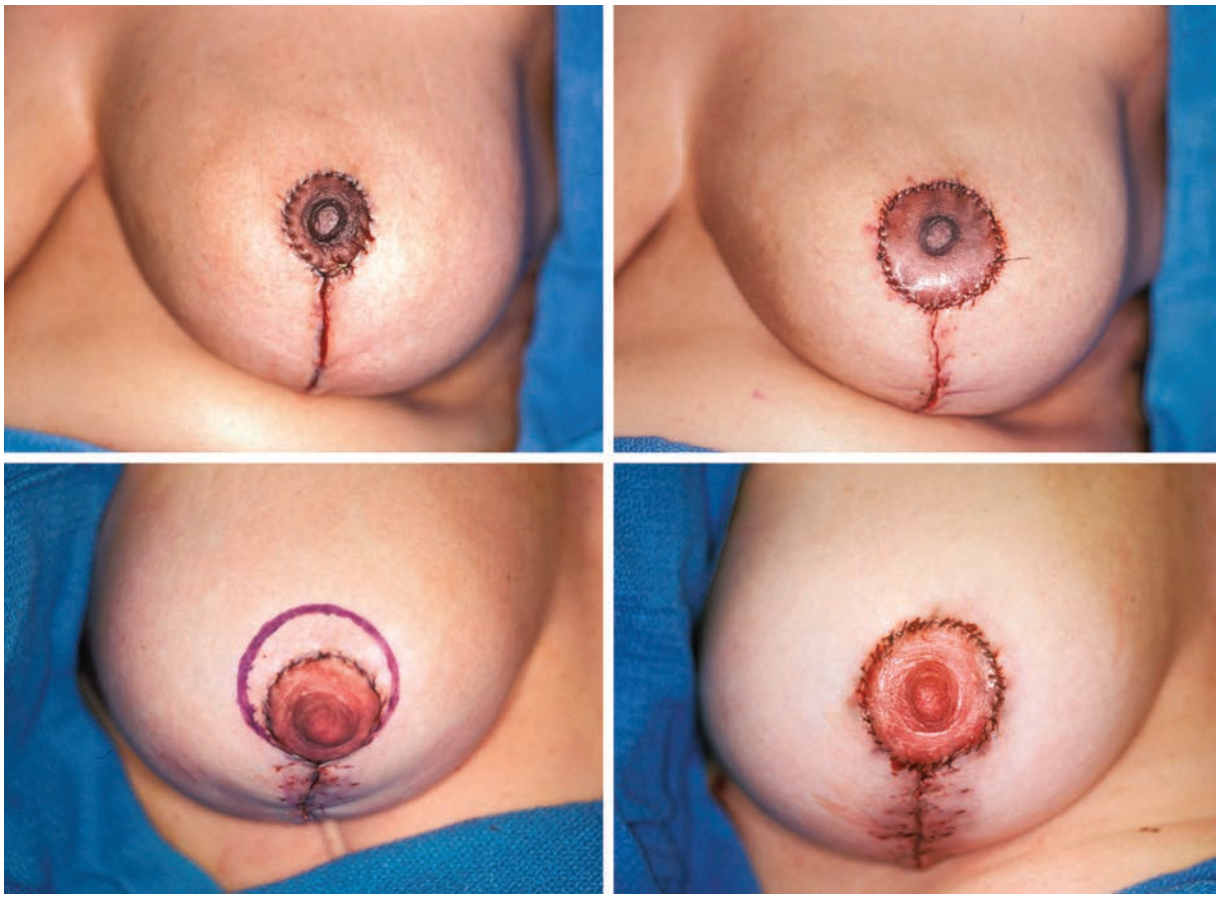

FIG. 5. Nipple-areola complex inset. (*Above, left*) Initial inset into the small-diameter areolar opening (see Fig. 4) reveals that the position of the nipple-areola complex is too high in this patient. (*Above, right*) Final closure is shown after the areolar opening has been redrawn lower and the diameter has been enlarged as desired. (*Below, left*) Initial trial closure of the areolar opening in this patient reveals that the nipple-areola complex is too low. (*Below, right*) Final closure is shown after the areolar opening has been redrawn higher and with the desired diameter.

ficient or the existing areolar diameter is small enough so that the vertical limbs can converge at the level of the estimated new nipple position without intersecting areolar skin. Closure of the vertical incision in these patients will therefore not include an areolar opening initially (Fig. 6). It is then a simple matter to design a new opening for the areola of the desired diameter and in the ideal position, after this is determined with the patient in a sitting position. This method of closed design is commonly utilized with the inverted-T method and can be used with vertical mammaplasty whenever conditions permit. This is a more flexible, accurate, and efficient method that is preferred to the open design.

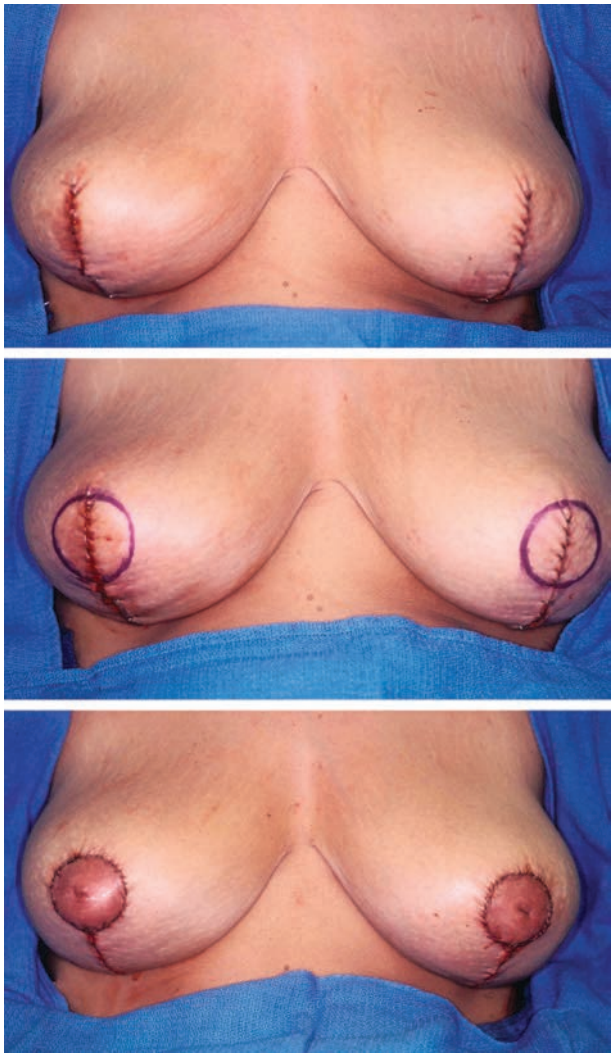

FIG. 6. Closed areolar design technique. A closed design does not have a predetermined areolar opening. The vertical limbs in some patients can be drawn to skirt the areola completely to intersect at the level of the new nipple position. This method provides the greatest flexibility for determining nipple-areola complex position and final diameter. (*Above*) The closed design is shown after completion of resection and before nipple-areola complex insetting. (*Center*) The areolar opening is designed at the appropriate height and with the desired diameter. (*Bottom*) The nipple-areola complex is shown after final inset.

Another observation in areolar opening design is that the vertical mammaplasty technique appears to inherently produce more tension on the areolar closure. This is probably due in part to the increased subareolar volume that is the basis for the improved projection seen with this technique. The use of a larger template (45 to 50 mm) for marking the initial circumareolar incision will contribute to reduced tension on the final circumareolar closure and is recommended as a routine. In addition, the new areolar opening should be sized more conservatively. The diameter of the opening should be marked no larger than 4 cm and ideally should not measure more than 4.5 cm *after* skin excision and before any sutures are placed for closure.

GLANDULAR RESECTION CONCEPTS

Previous publications on vertical mammaplasty have emphasized extensive undermining of the lower pole skin as an important initial step after making the skin incisions and just before beginning resection.[6,7] Although this practice facilitates the ability to purse-string the vertical incision to a significantly shorter length in large breasts, it often causes considerable puckering of the lower pole skin. This contributes to a poor intraoperative and early postoperative appearance. In addition, detaching the skin from the medial and lateral pillars removes a source of blood supply to these structures that can theoretically contribute to the development of fat necrosis in the pillars. The concept of extensively undermining the lower pole skin just before resection has not proven necessary to achieve excellent results and should generally be avoided.[4]

Glandular resection in vertical mammaplasty begins with excision of the inferior breast tissue between the vertical skin markings. This tissue is resected straight down toward the chest wall but not deep enough to expose the pectoralis muscle. A layer of breast tissue is left intact over the muscle at the base of the excision. An important exception to resection of the area between the vertical incisions occurs in the patient with ptosis and small breast volume when a mastopexy is being performed. Most of these patients should have skin exci-

TABLE I
Causes of Lower Pole Deformity

Finding	Cause
Long lower pole	Patient selection (too big for technique)
	Nipple position too high
Boxy lower pole contour	Excess glandular tissue lateral to pillars
	Excess skin in the horizontal dimension at the bottom of the vertical design due to using a "V" skin incision design instead of a "U" (see text)
Flat lower pole contour	Inadequate pillar volume to maintain full vertical breast height along the breast meridian ("I" beam principle, see text)
	Vertical limbs not far enough apart during skin incision design
	Loss of vertical pillar height at breast base due to incomplete suture of pillars together for their full height
Subareolar flattening or depression	Inadequate pedicle or pillar volume in this area
	Seroma with bursa formation and contracture
	Fat necrosis (rare)
Notching or clefting at breast base	Overresection of dog-ear soft tissue (dermis adheres to chest wall)
	Incomplete closure of pillars at breast base

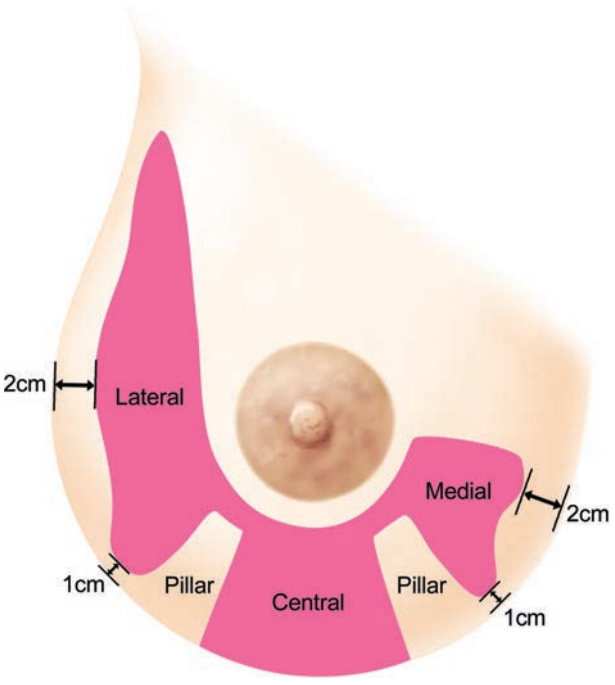

FIG. 7. Resection plan diagram. The shapes of the areas to be resected are shown in *pink*. The central segment represents the tissue between the vertical incisions. The medial resection generally does not extend higher than the transverse meridian of the breast. The area of lateral resection is usually excised in two or three separate pieces to provide optimal exposure and facilitate maintaining an even thickness to the skin envelope as resection progresses. Note that the resection approaches the skin more closely adjacent to the lateral aspect of both pillars.

FIG. 8. The medial and lateral resections are indicated in this immediate postoperative view of the right breast by the patterns with *diagonal lines*. The lateral extent approaches the axilla on the *left*. Both resection areas just lateral to the pillars (*P*) approach closer to the skin to reduce the thickness of the skin envelope in these areas. This will help to prevent a boxy breast shape.

sion only *without* glandular resection (Fig. 2). Insufficient glandular volume in these patients predisposes to flattening of the lower pole or even clefting along the vertical incision, because there is insufficient soft-tissue volume to maintain the shape of the lower pole in the face of wound contraction forces in the vertical closure. It is therefore better to imbricate the retained tissue between the vertical incisions to simulate approximation of the medial and lateral pillars.[21]

Resection of the glandular tissue between the vertical incisions is followed next by resection of the medial and lateral portions of the breast. A "pillar" of tissue is formed during the process of resection on each side. These pillars are attached to the overlying skin throughout their length and also to the chest wall at the base of the breast above the inframammary crease. It is important that these pillars have adequate dimensions. They should be more substantial at the base (chest wall attachment),

where they typically measure 3 cm in craniocaudal length and 2 cm in width. The thickness of the pillar tapers superiorly to as little as 1 cm as it approaches the areola, but it should remain 2 cm wide throughout its length.

Inadequate pillar dimensions can have negative consequences, such as lower pole flattening at the base, clefting of the lower pole (inadequate pillar volume to resist forces of wound contraction in the vertical scar), and infra-areolar depression or flattening (pillar volume inadequate superiorly) (Table I).

Boxy breast shape can also result from vertical mammaplasty. One cause is a skin envelope that is not tight enough because of inadequate displacement of the breast to each side during the skin-marking process. This can be corrected later in the procedure by plicating the vertical incision until the shape is improved. Another cause is too much glandular tissue volume left just lateral to the pillars at their base. This can be avoided during resection by extending glandular excision closer to the skin just lateral to the pillars on each side (Fig. 7). This means approaching to within approximately 1 cm of the skin in these specific areas. The thickness of the skin envelope for the remainder of the medial and lateral resection beyond these areas should be at least 2 cm. Maintaining a skin envelope of uniform and adequate thickness is particularly important in the lateral breast to avoid the appearance of ripples and indentations that will otherwise become immediately evident when the drains are placed on suction.

Medial resection generally extends as high as the level of the nipple, although in larger breasts it may need to extend higher than this (Figs. 7 and 8). Lateral resection extends as far as the axilla. It is recommended that the lateral resection be accomplished in two or three separate pieces. This will improve exposure during resection and facilitate creation of an evenly thick skin envelope. The chest wall musculature is not exposed at any time during the course of resection.

The conical breast shape that vertical mammaplasty methods can produce requires a longer lower pole (i.e., more skin) than is provided by inverted-T methods. It also requires retaining sufficient pedicle volume to fill out this larger anterior skin envelope and achieve superior projection. Aggressive resection of the deep portion of the superior pedicle can produce a flat upper pole contour with poor overall projection, a result that will simulate many inverted-T results. In addition, the skin of the upper breast can be permanently dimpled in the case of more extreme overresection in this area. Resection of the deep portion of the pedicle should therefore be performed conservatively at first. Additional tissue can be removed if temporary closure and viewing of the breast in the sitting position suggests that more pedicle volume is expendable without adversely affecting overall shape and projection.

Vertical mammaplasty fundamentally differs from inverted-T techniques in that the center of the breast is resected instead of the periphery of a central mound. When the incisions are closed temporarily to gauge the endpoint of resection, with the patient in a sitting position, the central cavity often does not collapse completely, particularly in large reductions. As a result, the amount of resection actually performed can be underestimated. It is therefore essential to use drains with this method of vertical mammaplasty, so that this cavity is collapsed completely and the actual amount of resection is made more evident. A second consequence of resecting the center of the breast is that a persistent dead space can form that

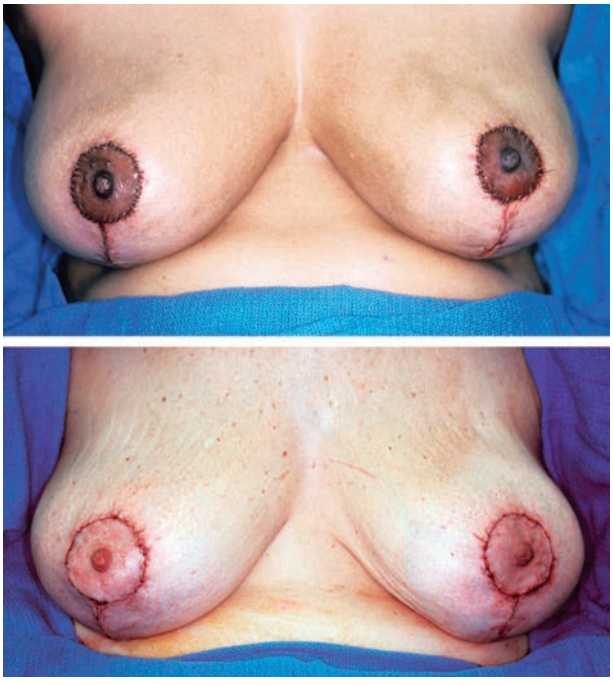

FIG. 9. Two patient examples illustrate the intraoperative appearance of vertical mammaplasty at the conclusion of the procedure. There is no distortion present, and the result does not change appreciably with time. These results are typical when utilizing the techniques described in this report.

FIG. 10. Mastopexy. (*Above*) Preoperative views and (*below*) 6-month postoperative views. A total of 79 g of breast tissue have been removed on the right side, and 80 g have been removed on the left.

may lead to seroma formation postoperatively. This is more likely to occur as resection volume increases. This is an equally important reason to use drains in vertical mammaplasty. The drains are typically inserted through a separate stab incision in the crease adjacent to the vertical incision and are left in for approximately 1 week. This is an important distinction from inverted-T methods, in which drains are either generally regarded as optional or removed early if used. The method of vertical mammaplasty described in this report also differs in concept from most previous descriptions of the technique, where the vertical closure is performed in a tight, compressive manner that may obviate the need for drains but results in considerable early distortion of the lower pole.

The glandular resection concepts described here do not include liposuction as an important adjunctive technique, even though generalized liposuction of the breast before glandular excision has previously been advocated as a

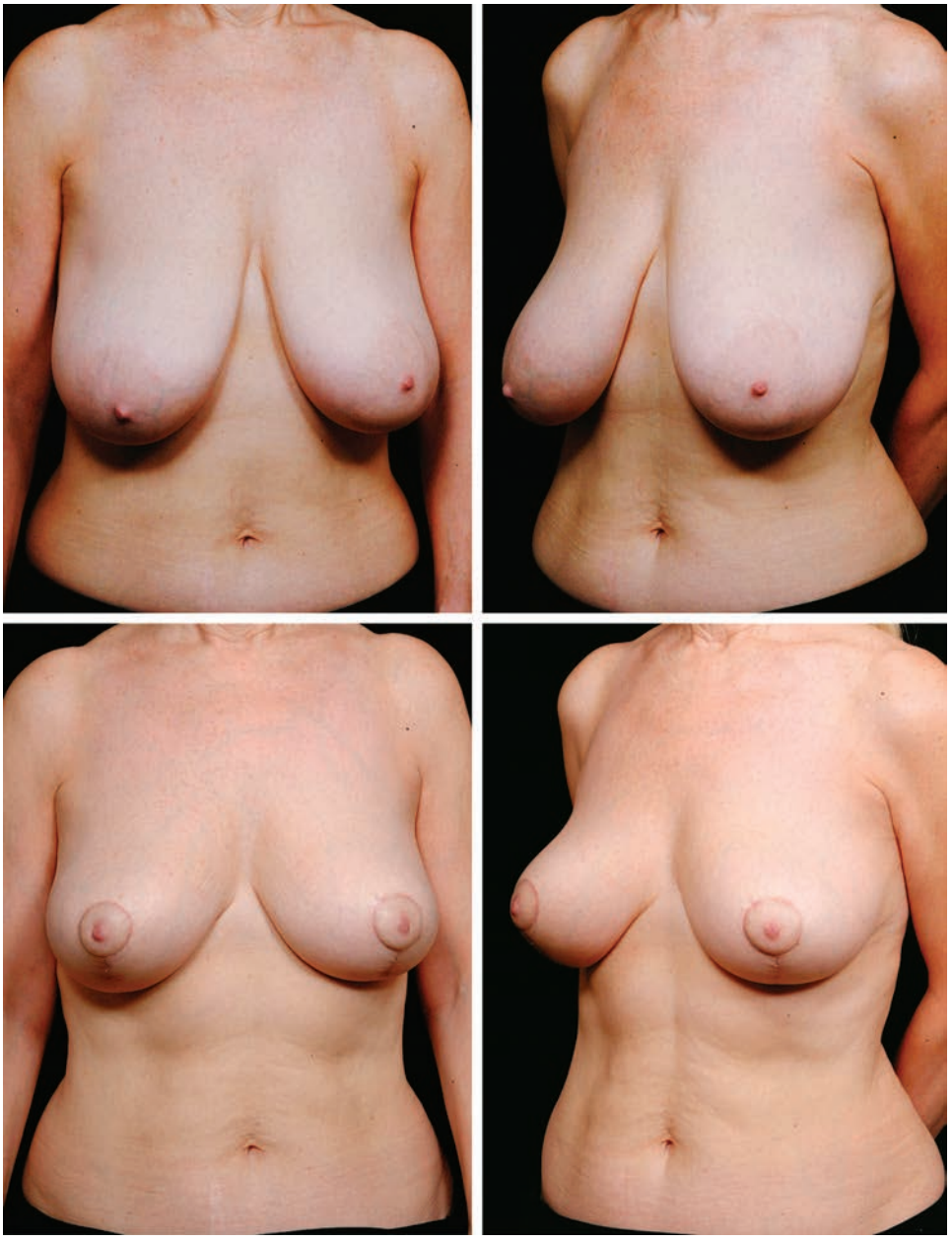

FIG. 11. Reduction. A total of 214 g of breast tissue have been removed on the right side, 196 g have been removed on the left.

routine.[6–8] Concerns regarding extensive liposuction include possible compromise of pedicle vascularity, compromise of the structural integrity of the pillars, possible fat necrosis occurring as a result of both liposuction and simultaneous resection, and an increased incidence of hematoma, seroma, and other complications.[21,25] In addition, distortion of the breast from tumescent injection may hamper efforts to accurately judge the endpoint of resection. Others have demonstrated excellent long-term results without using generalized liposuction of the breast.[4] Liposuction is most useful in vertical mammaplasty as a minor adjunct to treat either an associated lateral chest wall fullness or a particularly prominent anterior axillary fold.

CLOSURE CONCEPTS

It has not proven necessary to suture the glandular tissue to the pectoralis major muscle at an elevated level during closure, as described by Lejour.[6,7] This practice causes considerable distortion of the breast and contrib-

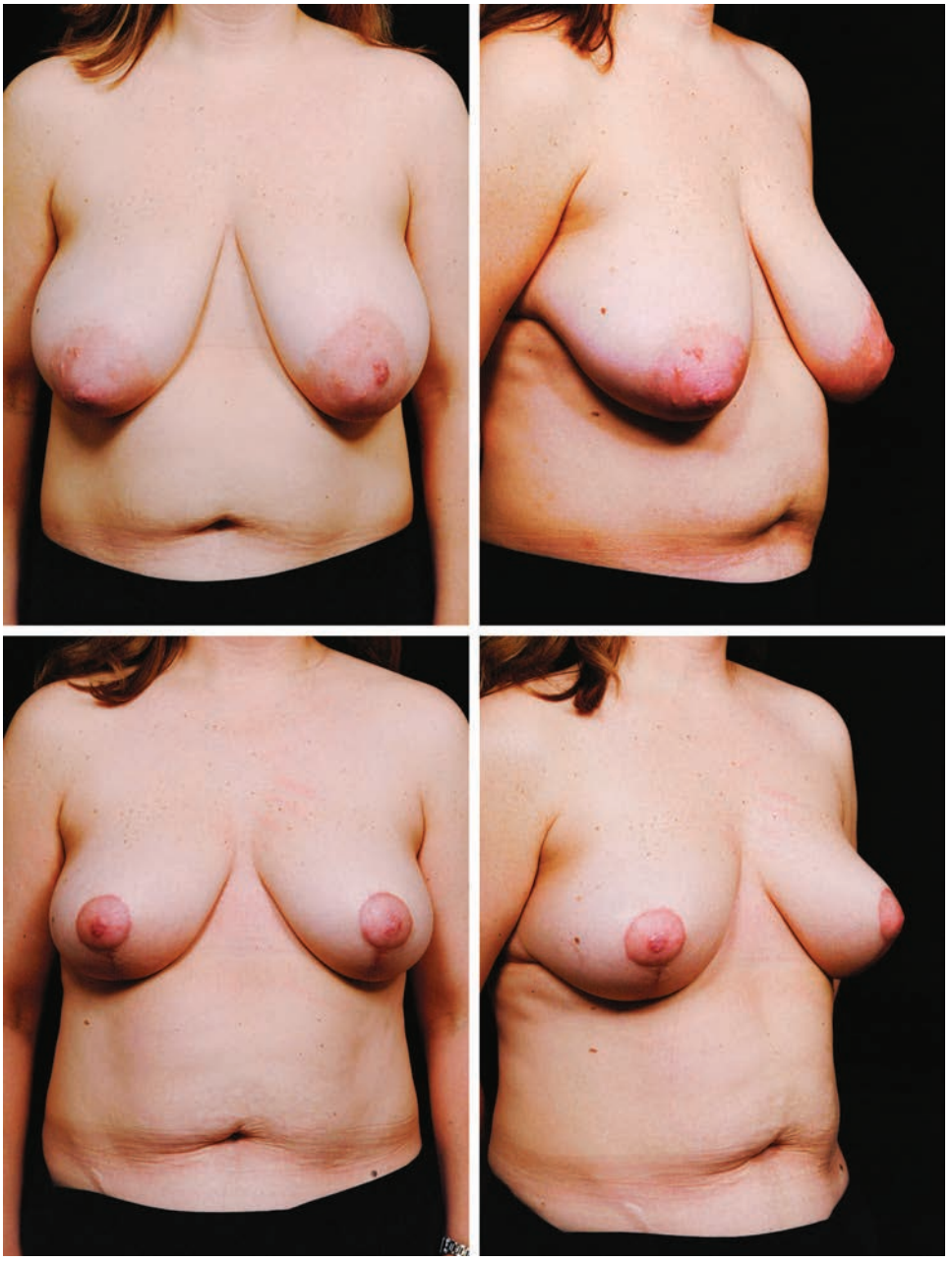

FIG. 12. Reduction. (*Above*) Preoperative views and (*below*) 5-month postoperative views. Each side had 242 g of breast tissue removed.

utes to a poor intraoperative and early postoperative appearance. In fact, suture of the gland to the underlying muscle is entirely unnecessary and of no proven benefit. Excellent long-term results can be achieved without embracing this concept, and its use is not recommended (Figs. 9 through 16).[4]

Proper management of the vertical closure is important to avoid a variety of potential lower pole aesthetic problems (Fig. 17) (Table I). Closure begins by placing two or three sutures to approximate the pillars, beginning at the chest wall and progressing anteriorly for about 2 cm along the superior surface of the pillars (Figs. 18 and 19). Progressing further anteriorly is not helpful and doing so will constrict the lower pole shape. Placement of these sutures will maintain the height of the pillars. This prevents them from collapsing away from one another under the weight of the pedicle as the incision is closed, a scenario that can result in a flattened lower pole shape. The pedicle and the sutured pillars together form a central column of tissue (much like an I-beam) that

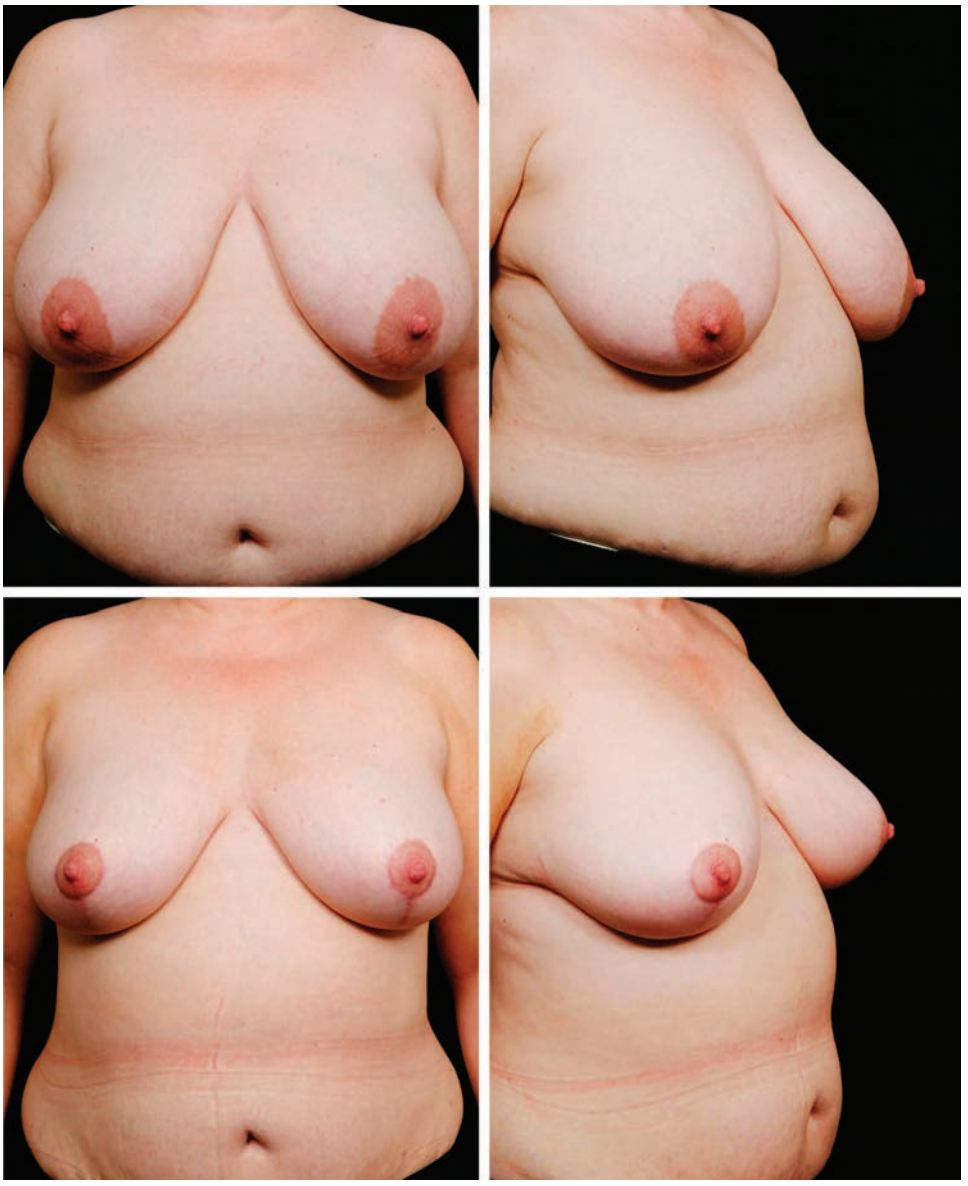

FIG. 13. Reduction. (*Above*) Preoperative views and (*below*) 9-month postoperative views. On the right side, 411 g of breast tissue have been removed; 415 g have been removed on the left.

establishes and maintains an appropriate vertical dimension through the center of the breast.

It is important to retain sufficient soft-tissue volume deep to the vertical closure just inferior to the areola. Inadequate volume in this region can result in either a flat area or depression at the top of the vertical incision as wound-healing progresses. Pillar tissue and the most dependent portion of the pedicle normally fill this area. The pedicle should extend by design for several centimeters inferior to the areola to provide adequate soft-tissue bulk deep to the top part of the vertical closure. This problem of flattening inferior to the areola is more apt to occur in smaller breasts that have loose skin. It can be difficult to create pillars of adequate thickness due to a paucity of glandular tissue in these patients. It is therefore particularly important to retain adequate pedicle volume in this scenario.

It is important to securely approximate the pillars to the very bottom of the incision. Incomplete closure of the pillars at the bottom done purposefully to minimize the size of the dog-ear can result in a depression or even notching in this area. This problem results from adherence of the skin to the chest wall because of a lack of intervening soft tissue. This same problem can also result from excessive debulking of a prominent dog-ear (Table I).

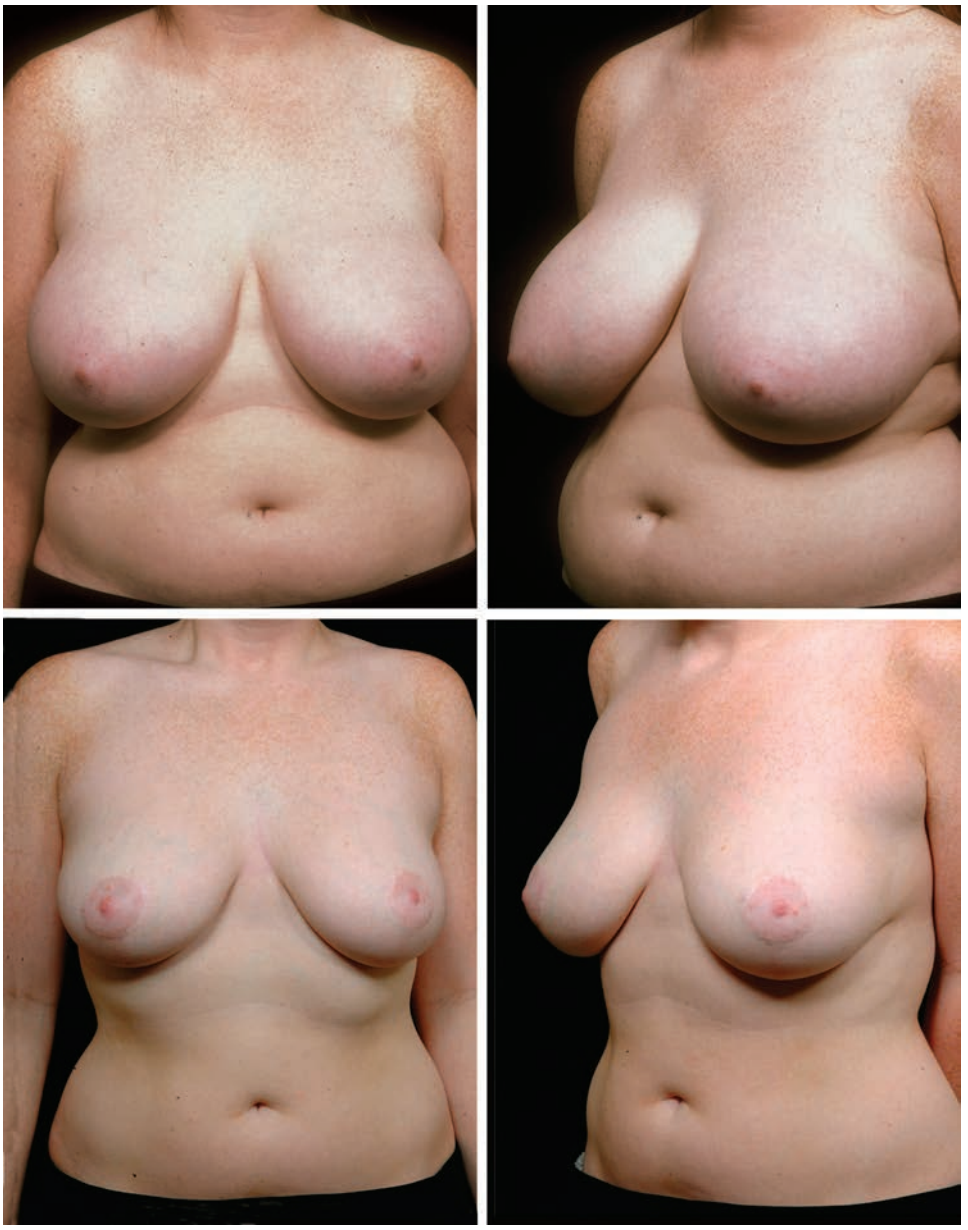

FIG. 14. Reduction. (*Above*) Preoperative views and (*below*) 3-year postoperative views. On the right side, 508 g of breast tissue have been removed; 496 g have been removed on the left. Some areolar asymmetry is evident.

Lower pole distortion is also caused by excessive tension on the incision closure in an attempt to significantly shorten overall lower pole length. This maneuver is advocated by some as an important part of the procedure.[6,7] However, excessive purse-string tension on the incision may cause clefting of the lower pole. It can also distort the lower half of the areola, making it more of a diamond shape than a round one. A simple way to avoid these problems is to close the superior portion of the incision under normal tension, tie the suture just above the dog-ear, and then continue it inferiorly, placing great purse-string tension only on the dog-ear to flatten it. It is normal for lower pole length to measure 9 to 10 cm. Attempts to make it shorter than this with aggressive purse-string tension should be avoided. Lower pole length of this dimension is necessary to realize the improved projection that vertical mammaplasty offers. True excess length of the lower pole is usually avoided if the nipple is not positioned too high.

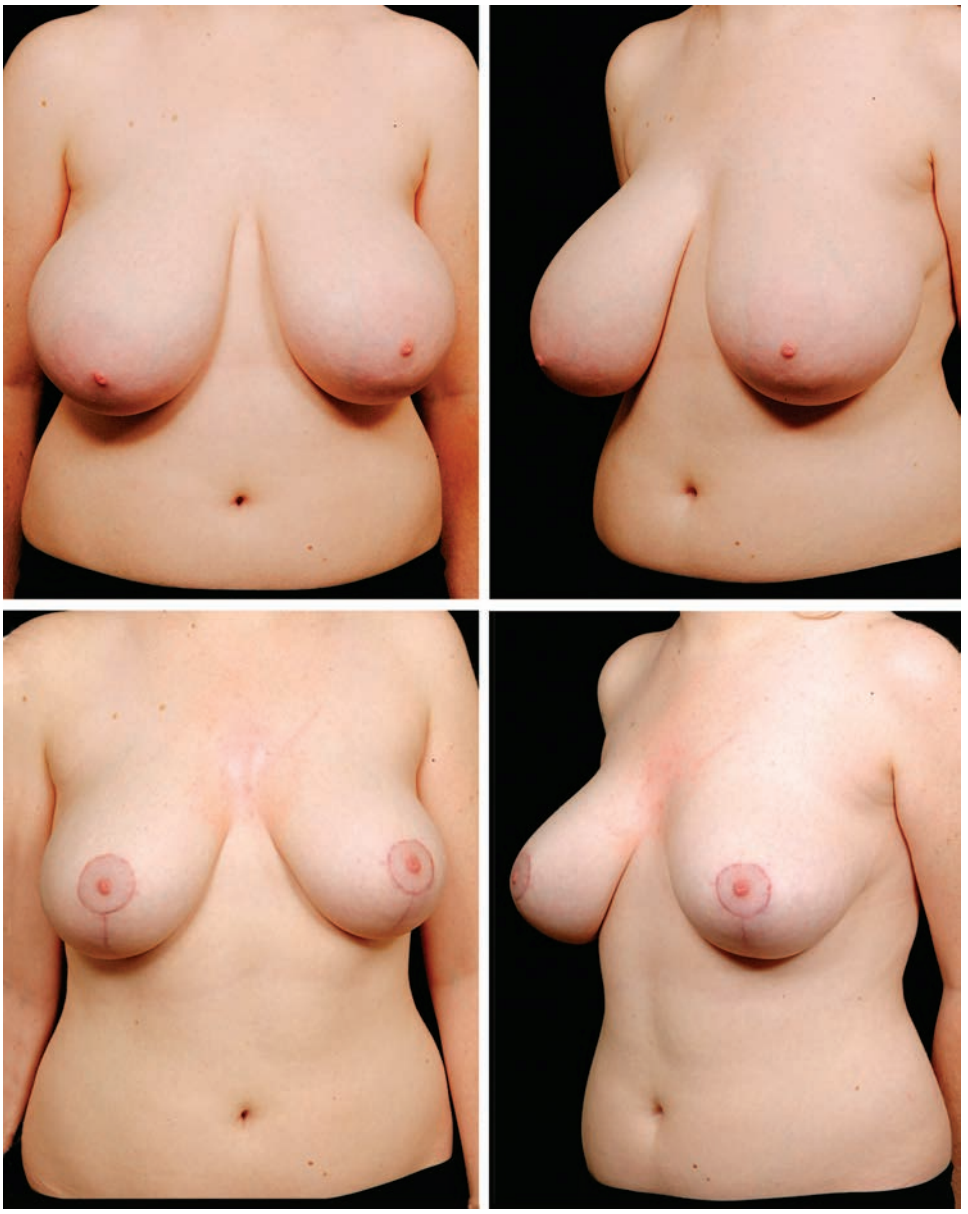

FIG. 15. Reduction. (*Above*) Preoperative views and (*below*) 7-month postoperative views. On the right side, 704 g of breast tissue have been removed; 638 g have been removed on the left.

In some patients, the lower pole can appear ptotic. This can be corrected intraoperatively by plicating the vertical incision further to raise and flatten the lower pole more. This simply corrects an overly conservative preoperative skin design where the vertical limbs should have been planned farther apart to begin with.

The problem of dog-ear formation at the base of the vertical scar is generally not significant. Slight debulking of the soft tissue and conservative skin excision in a *vertical* direction usually eliminates the problem in most patients. A preoperative skin incision design ending several centimeters above the inframammary crease prevents vertical excision of the dog-ear from extending below it later. It may prove to be necessary to perform a limited horizontal skin excision at the inframammary crease when reducing very large breasts. This will remove a problematic large dog-ear that adds unwanted length as well as bulk to the lower pole.

RESULTS

This practitioner first used vertical mammaplasty in 1998. The proportion of patients who underwent vertical mammaplasty increased

FIG. 16. Reduction. (*Above*) Preoperative views and (*below*) 1-year postoperative views. On the right side, 656 g of breast tissue have been removed; 740 g have been removed on the left.

from 66 percent in the first study year to 80 percent in the last study year. In most patients who did not undergo vertical mammaplasty, an inverted-T approach was used. The increased use of the vertical mammaplasty was due to growing confidence in the technique. The average weight reduction per side was 349 g in the first year of the study; this increased to 393 g per side in the last year of the study. Although these numbers may be considered small, this study includes mastopexy patients and is more reflective of the type of patient who typifies this practice. The smaller resection numbers do not indicate a limitation of the technique described, and patients who had resections as high as 840 g per side were included in the study group. The follow-up period ranged from 3 to 59 months, with an average follow-up of 8.4 months. Postoperative surgical and aesthetic problems are listed in Tables II and III. Five patients felt they were slightly underreduced (one patient underwent revision by liposuction only, and another patient underwent revision by excision), and an-

FIG. 17. (*Left*) Flat lower pole of the right breast. (*Right*) Bilateral flat lower pole deformity.

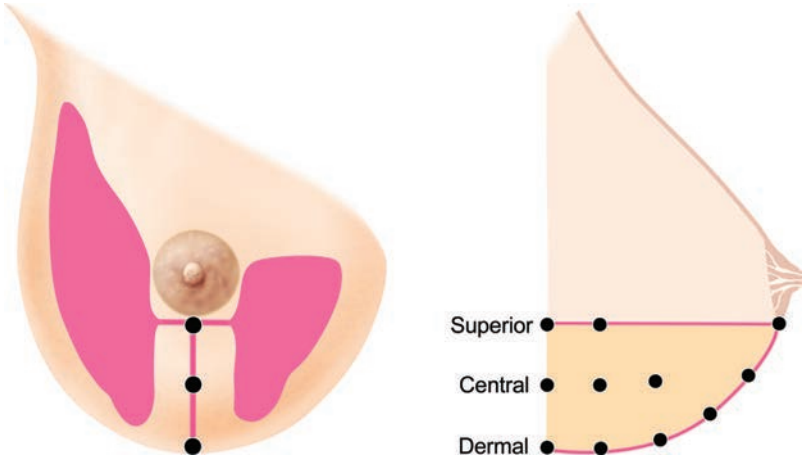

FIG. 18. *Black dots* represent individual suture positions for pillar closure. The superior row is necessary to preserve full pillar height. (*Left*) The pillars and superior pedicle together form a central "I-beam" that maintains the vertical height of the breast and thereby prevents lower pole flattening. (*Right*) There are only two to three superior row sutures. Extending this part of the closure further would constrict the lower pole shape. A similar effect occurs if the central row is extended too far from the chest wall.

other patient felt slightly large on one side. Most of the lower pole problems described were largely avoided later in the series as the surgical principles described above became firmly established.

DISCUSSION

Vertical mammaplasty is conceptually more challenging than the architecturally simple inverted-T technique. However, the technical concepts described in this report make the procedure more controllable intraoperatively and eliminate many of the previously described major complaints. Minor lower pole irregularities, a tendency for circumareolar scar hypertrophy, and minor areolar malposition can still occur despite considerable experience, although these problems are all avoidable with meticulous technique.

Vertical mammaplasty appears to yield stable long-term results. Lower pole descent does not appear to occur with time, as it does with inverted-T techniques.[21] The reason for this dif-

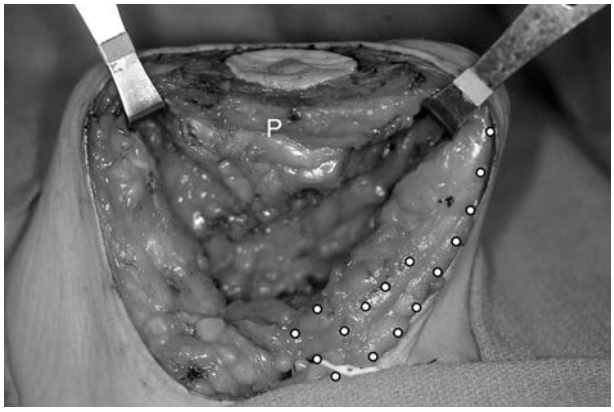

FIG. 19. Pillar closure. The superior pedicle (*P*) is seen above the pillars. The three rows of sutures that will be placed to close the pillars are indicated as *white dots* on one of the pillars. The superior, central, and dermal rows of sutures are shown (see also Fig. 18). These indicated points will be sutured to the corresponding point on the unmarked pillar to complete the vertical closure.

TABLE II
Surgical Problems in 134 Patients

Problem	No. of Patients	Percentage of Total
Seroma*	7	5.2
Minor wound-healing issue†	7	5.2
Hypertrophic scars	4	3.0
Nipple hypesthesia	3	2.3
Hematoma	1	0.7
Nipple necrosis	0	0
Skin slough	0	0

* All before policy of using drains.
† Suture sinus, self-limited wound drainage, and minor superficial slough.

ference between the two techniques remains unexplained.

Vertical mammaplasty has the potential for being more surgically efficient given that there are fewer incisions and their overall length is less than that for inverted-T methods. However, the procedure is not necessarily faster, because time is often spent making various adjustments during the course of the procedure. In any event, this is not the primary advantage of the technique.

The concepts discussed in this report represent an evolution from previous descriptions of vertical mammaplasty. Extensive liposuction of the breasts, suture of the gland high on the pectoralis muscle, lower pole skin undermining, predetermined size and position of the areolar opening, and aggressive vertical incision shortening are problematic techniques that have all been abandoned to yield aesthetically improved immediate results. Use of a superior pedicle or superomedial pedicle to allow adequate superior nipple transposition and pillars that are attached to both the skin and the chest wall are other features of the technique described herein. This method can be applied to the majority of patients who present for breast reduction, although those with very large breasts remain candidates for other methods, including techniques that use free nipple grafts.

TABLE III
Aesthetic Problems in 134 Patients

Problem	No. of Patients	Percentage of Total
Minor lower pole irregularities (flat, boxy, skin rippling)	11	8.2
Minor asymmetry (mound position, volume)	6	4.4
Revisions (reduce more, contour deformity, asymmetry)*	5	3.8
High nipple position	2	1.4
Long lower pole	0	0
Late lower pole "bottoming out"	0	0

* Includes some patients from first two categories.

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