Evolution of the Vertical Reduction Mammaplasty

Scott L. Spear, M.D., and Michael A. Howard, M.D.

Washington, D.C.

Learning Objectives: After studying this article, the participant should be able to: 1. Describe the surgical techniques for vertical reduction mammaplasty. 2. Discuss the pros and cons for each vertical reduction mammaplasty approach. 3. Determine which technique would be appropriate for a patient. (Plast. Reconstr. Surg. 112: 855, 2003.)

A recent survey found that the inferior pedicle, inverted-T skin pattern is still the most common breast reduction technique used among U.S. plastic surgeons. This technique has been widely taught in North America and is familiar to most American plastic surgeons. Using the skin markings of this technique, the glandular excess, skin envelope, and nipple position may be readily and reliably addressed.

Surgeons recognize some potential drawbacks to this procedure, particularly the long infra-mammary transverse scar and a propensity for pseudoptosis or “bottoming out.” Over time, various authors have sought to address these issues through the vertical reduction pattern. However, this method of breast reduction has been the topic of heated debate and remains a source of great confusion to many. Reviewing the evolution of vertical reduction mammaplasty techniques should help to clarify some of the misconceptions that persist surrounding this topic.

It is critically important to realize that in breast reduction surgery, the pedicle and the skin excision pattern can be independent variables. Wise’s original description in 1956 was of a skin excision pattern only. The Wise “inverted-T” and “vertical” patterns may both be combined with several different nipple pedicles, including an inferior, central, superior, medial, lateral, or McKissock bipedicle. Most of the well-known named procedures have both a specific pedicle and a distinct incision pattern. Reviewing the evolution of vertical reduction techniques should help clarify the current state of the art of this method of breast reduction, including the pros and cons of each specific procedure.

LASSUS

The initial descriptions of vertical mastopexy were by Dartigues in 1924 and later by Arie in 1957. Lassus reintroduced the vertical technique with his own style of vertical reduction technique in 1970. This technique involves an en bloc resection of inferocentral skin, fat, and gland. The nipple-areola complex is transposed onto a superiorly based dermoglandular flap. The lateral skin and breast flaps are closed together centrally in a vertical scar pattern on the breast meridian. No lateral or medial flap undermining is performed. Using Lassus’s original description, the postoperative vertical scar often extended vertically below the fold toward the abdomen in large reductions. To avoid this complication, Lassus then added a short horizontal incision at the fold. However, Lassus later reverted to a vertical-only scar by limiting the inferior extent of resection and gathering the inferior skin.

Currently, Lassus’s technique is based on a superior dermoglandular pedicle (Figs. 1 and 2). The initial skin markings, made preoperatively with the patient in a sitting position, include two key landmarks. The first point (point A) is the future location of the new nipple. It is set on the breast meridian at a level 2 cm below...
the midpoint of the acromion-olecranon distance. The second point (point B), also on the breast meridian, is located 4.5 cm above the inframammary fold. The breast is then displaced medially and laterally and the two points are joined by curved vertical marks, which form an ellipse. The superior portion of this ellipse is the area to be deepithelialized, whereas the inferior portion is included in the en bloc resection.

Deepithelialization of the superior flap is performed initially. Inferior to the level of the nipple, the lateral and medial margins of the ellipse are incised to the chest wall and a central wedge resection is performed. Dissection posterior to the nipple is performed up to
point A, leaving 0.5 to 1.0 cm of glandular lining beneath the nipple. No further undermining is required. The lateral and medial portions of the breast are sutured together. Subsequent central tailoring and resection are performed as needed. Final breast shaping is performed along the vertical limb at the skin level as needed.

The postoperative breast is noted at first to have dramatic upper pole fullness, and final shape is only achieved after settling for a minimum of 2 to 3 months. According to Lassus, final breast shape and support do not rely solely on the “skin brassiere”; rather, the central vertical scar band supports long-term projection and shape.17,18

Pros

As currently described, the Lassus technique does not involve significant lateral breast gland or skin flap undermining, reducing the risk of gland or skin necrosis. The inferocentral wedge with vertical closure results in increased projection. According to Lassus, the postoperative breast has a stable shape and there is no need to reanchor the gland to the pectoralis muscle. Using this technique, Lassus claims that “nipple sensation is rarely disturbed.”17

Cons

With this method, the breasts have an initial distorted appearance, and significant settling is necessary before the final breast shape is apparent. Achieving predictable results is a potential problem because of the marked difference between the early and late appearance. Lassus also notes hypertrophic scarring in some patients near the inframammary fold.17

The superiorly based pedicle may be a limiting feature of this operation. This pedicle is not directly attached to the chest wall and therefore does not have a direct vascular supply. In addition, superior translocation of the nipple requires folding of the pedicle. When

Fig. 3. The Lejour vertical reduction mammoplasty: Preoperative markings. Before the procedure, the breast is deviated medially and laterally and marked in line with the meridian. These lines are connected above the inframammary fold. The future position of the nipple is determined, and a free-hand “mosque dome” is drawn 2 cm above the nipple, connecting to the vertical lines. (Reprinted with permission from Lejour, M. Vertical mammoplasty for breast reduction and mastopexy. In S. L. Spear (Ed.), Surgery of the Breast: Principles and Art. Philadelphia: Lippincott-Raven, 1998. P. 735.)
using this technique, Lassus avoids transposing the nipple more than 9 cm. If more than 9 cm of vertical movement is required, the dermoglandular pedicle may be kinked, which may result in necrosis of the nipple-areola complex. As such, this technique is less reliable in the setting of significant ptosis or hypertrophy. Also, in the setting of large reductions, migration of the vertical component of the scar below the inframammary fold is more likely to occur.

**LEJOUR**

In the early 1990s, Lejour introduced her technique of vertical mammoplasty. Her approach included adjustable skin markings, initial liposuction for volume reduction, and extensive lower lateral breast skin undermining. Similar to the method of Lassus, her method also uses a superior dermoglandular pedicle for the areola and central breast reduction. Similar to Lassus procedure, at the time of the operation, overcorrection in the superior direction is the goal, to allow the breast to settle inferiorly into the final shape.

Preoperative markings are made with the patient in an upright position. The midline, infra mammary fold, and future nipple position are marked according to the preferred method of the surgeon. Extending from the inframammary fold, the vertical axis of the breast is marked, usually 10 to 12 cm from the midline. The breast is then elevated superiorly, deviated medially and laterally, and marked in line with the vertical axis (Fig. 3). These marks determine the medial and lateral margins for skin excision and are joined by a curvilinear line above the level of the inframammary fold. The level of the future nipple is

![Fig. 4](image-url). A superior dermoglandular pedicle carries the nipple-areola complex. Volume reduction is achieved through liposuction and a central breast segment resection.
determined by the surgeon’s preferred technique. A free-hand, curvilinear marking resembling a “mosque dome” joins the vertical marks at a point 2 cm above the future nipple site. This upper mark must be increased in size for larger reductions.21,23

The procedure begins with infiltration of the breast with 20 to 40 cc of a vasoconstrictive agent. The upper area within the markings is then deepithelialized to a point 2 to 3 cm below the areola. Liposuction of the breast is then performed, when possible, from all parts and levels of the breast, avoiding only the area behind the areola. One must caution against overreduction of the lower pillars in fatty breasts because this will leave them too soft for future suturing and will not provide postoperative structural support.22

Incisions are then made at the lateral breast markings (Fig. 4). Wide skin undermining is performed medially, laterally, and inferiorly to the level of the inframammary fold in a plane similar to a subcutaneous mastectomy. This superficial dissection contributes to skin draping and contraction postoperatively. If the undermining is performed at a deeper plane, an abnormal lower breast bulge may result. No undermining is performed outside the periareolar markings. The lower, central segment of the breast is elevated off the chest wall from the inframammary fold to the upper margin of the gland, creating a 6-cm to 8-cm central tunnel. Vertical cuts are made in accordance with the degree of desired reduction, creating the new medial and lateral pillars. A 2-cm-thick to 3-cm-thick superior dermoglandular pedicle is elevated, completing resection of the lower, central segment.20–23

Closure of the reduction begins with a single, heavy, absorbable stitch to elevate the nipple to its new position. The suture begins at the level of the future areola on the deep surface of the pedicle and is sewn to the pectoralis muscle at the highest level of dissection. The medial and lateral pedicles are sutured, creating a conically shaped underlying breast mound. At this point, the skin flaps appear excessive; however, no further resection is performed. Rather, the skin flaps are gathered and closed in two layers. Sufficient skin gathering must be performed with this vertical suturing to reduce the closure length to 6 to 7 cm. A longer closure length must be avoided, which can result in final scar extension below the inframammary fold.21

**Pros**

In 1999, Lejour published a 10-year follow-up and evaluation of this technique.21,23 Using this technique, she describes being able to achieve a safe breast reduction with an aesthetically pleasing outcome. After achieving the final postoperative shape, the reduced breast attained a stable, conical shape with minimal scarring. The internal suturing of the medial and lateral breast pillars provides postoperative breast shape and projection. Furthermore, according to Lejour, there is no reliance on the skin envelope to shape the postoperative breast. The use of liposuction leads to less tissue resection and, therefore, increased preservation of the nerves and vessels. Only one patient experienced permanent sensation loss in the original Lejour series.23 In addition, future weight loss or gain after reduction will lead to less shape change because of less fat in the postoperative breast.20,22

In this method, a wide areola pedicle and blood supply is created and no undermining of periareolar skin is performed. Lejour noted partial areola necrosis in two of 250 patients (0.8 percent), only one of which required surgical revision. Areolar sensation appears to be preserved through sources other than the lateral perforator of the fourth intercostals nerve. In her series, seven of 170 patients experienced

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**Fig. 5.** Immediate postoperative result of the Lejour technique. Note the conically shaped breast with superior pole fullness and gathered vertical scar, which require significant postoperative settling.
a reduction in sensation and only one of 170 had complete loss of sensation.  

Cons

With this technique, there must be a great deal of patience on the part of the surgeon and patient in the postoperative period. Early breast shape is characterized by exaggerated projection, and up to 6 months may be required for the breast to settle and achieve its final shape and for the gathered vertical scar to smooth and flatten (Fig. 5). Breast skin excess may also be evident at the inferior portion of the vertical scar, particularly in large volume reductions. Revision of the vertical scar or a secondary, horizontally oriented excision of excess tissue is often necessary. Volume reduction relies heavily on liposuction, which is not feasible in dense, glandular breasts. In very large reductions or extremely ptotic breasts, a long superior pedicle is required to transpose the nipple and may not be reliable. Delayed healing has also been noted to occur more frequently using this method.  

In addition, although Lejour reports that "a few" patients were able to breast-feed following use of her technique, preoperative counseling should probably include the likelihood that nursing is less likely after this procedure.

THE HAMMOND PROCEDURE: SHORT-SCAR PERiareolar Inferior Pedicle Reduction MAMMAPLASTY

Hammond introduced the short-scar periareolar inferior pedicle reduction mammoplasty in 1998. His goal was to establish a vertical reduction technique to limit scarring while maintaining the safety and familiarity of the inferior pedicle for the nipple-areola complex. The procedure begins with the patient

![Fig. 6. Short-scar periareolar inferior pedicle reduction mammoplasty: preoperative markings. The future position of the nipple is set at the level of the inframammary fold. The medial and lateral margins of the periareolar resection are determined by deflection of the breast and marking in line with the meridian from above and below the breast.](image)
upright and marking of the midline, infra-
mammary fold, and the breast meridian (Fig. 6). The future site of the nipple is transposed
through the breast at the level of the infra-
mammary fold (point A). An 8-cm-wide pedicle
is drawn at the inframammary fold, centered
on the meridian, and extended superiorly 7 to
8 cm. The superior point of this pedicle at the
meridian is point B. The breast is displaced
superomedially and superolaterally where
points C and D are drawn on the breast in line
with the transposed meridian marks from
above and below the breast (Fig. 7). Points A
through D are connected in a circle or slight oval.

In the operating room, the areola is marked
and the skin is deepithelialized to the lower
portion of the oval. At this point, medial, lat-
eral, and superior flaps are developed. These
flaps begin at a thickness of 1 cm and gradually
thicken to 3 to 4 cm at the base. The superior
portion of the inferior pedicle is developed,
and caution is taken not to undermine the pedicle. A crescent-shaped portion of tissue is
removed from medial, superior, and lateral for
the initial reduction. Further volume reduc-
tion is attained by judicious thinning of the
breast flaps and pedicle. The areola is tempo-
arily tacked in the new periareolar incision.
The remaining skin is grasped from the infero-
medial and inferolateral breast flaps, gathered
to the midline, and stapled along the length of
the inferior pedicle mark. This area of “tailor-
tacking” is marked, the staples are released,
and this area is then deepithelialized. The area
of deepithelialization never extends below the

Fig. 7. Diagrams of the short-scar periareolar inferior pedicle reduction resection technique,
which includes an inferior pedicle for the nipple-areola complex, a purse-string periareolar
closure, and vertical deepithelialization and closure.
inframammary fold. At this point, the inferior pedicle is further developed and fixed to the chest wall. Two fixation points, one superior and the other medial to the nipple-areola complex, are sewn to the underlying pectoralis major. The vertical limb is closed with interrupted intradermal sutures. A running Gore-Tex purse-string closure is performed for the
periareolar incision followed by intradermal closure.

**Pros**

The short-scar periareolar inferior pedicle reduction technique has the advantage of the safety and familiarity of the inferior pedicle. Hammond reports that the fat and parenchyma posterior to the nipple are retained; thus, less future breast flattening is noticed. There is little reliance on postoperative change or settling for the final breast shape. There should be no more bottoming out or loss of superior pole fullness than seen with other inferior pedicle techniques. In the setting of large reductions, significant superior translocation of the nipple is not limited by the possibility of superior pedicle vascular compromise. The gathering of excess breast skin with both a purse-string periareolar closure and a vertical seam reduces the skin wrinkling associated with the purse-string suture alone or this isolated vertical closure with the standard periareolar closure.

Another major advantage of this procedure is its combination of both the purse-string and vertical techniques for skin reduction rather than relying on just one. This is truly one of several “circumvertical” methods.

**Cons**

Drawbacks to the short-scar periareolar inferior pedicle reduction technique include a re-

![Fig. 9. The Hall-Findlay technique. The medial and lateral breast pillars are closed and a subcuticular running suture gathers the vertical incision during closure.](image-url)
ported incidence of periareolar scar widening (17 percent) and wrinkling (11 percent). Postoperatively, sensation was decreased or absent in 28 percent of patients. Although the Gore-Tex suture is soft and pliable, stable closure is dependent on this suture. If this suture is disrupted, significant scar or areola widening may occur. Hammond recommends caution using this method for reductions greater than 1000 g until experience with the technique has been accrued.

The technique does not alter the position of the inframammary fold and may tend to maintain the residual breast tissue at the inferior pole of the breast, which, in our opinion, can lead to excessive inferior breast fullness. Also, other techniques require less skin excision as the inframammary fold is elevated and excessive breast skin is redistributed to the chest wall. Finally, this technique, similar to other inferior pedicle techniques, requires significant time for deepithelialization, at both the beginning and midway through the procedure.

**HALL-FINDLAY**

Seeking to avoid a horizontal scar and prevent postoperative bottoming-out, Hall-Findlay initially began using the Lejour vertical reduction technique. However, in 1999, she introduced modifications of Lejour’s procedure, which allowed her to apply the vertical technique to larger breast reductions. This procedure originally described using a vertical reduction scar pattern and a superomedial or superolateral dermoglandular pedicle (Figs. 8 and 9). More recently, Hall-Findlay has moved almost entirely to a superomedial approach.

Hall-Findlay’s technique begins with preoperative marking with the patient in the standing position. The inframammary fold and meridian are marked. The future nipple location is set at or just below the level of the fold. Similar to Lejour’s method, a mosque-like areola pattern is marked. Vertical limbs, similar to
the Wise pattern, are drawn. However, at 5 cm above the fold, the lines are curved downward to meet each other in a circular fashion, 2 to 4 cm above the inframammary fold. The dermoglandular pedicle is preferentially based medially with a width of 6 to 8 cm and extended to a 1-cm border around the areola. A larger pedicle width may be created for longer pedicles, and a laterally based pedicle may be chosen if this significantly shortens the pedicle length.

Under general anesthesia, the pedicle is deepithelialized and incised vertically to the chest wall. The remaining skin and gland are resected as a single C-shaped piece (Fig. 8). The amount of reduction can be tailored at this point to the patient’s ultimate breast size goal. Closure of the lower end of the areola opening is performed with a single stitch. The pedicle is rotated into position and the medial and lateral breast pillars are closed in an inferior to superior direction. Buried deep dermal sutures and a running subcuticular suture are used to gather the skin of the vertical limb.2

Pros

This technique involves Lejour-style skin markings with a medial dermoglandular pedicle for the nipple-areola complex. This technique creates a short pedicle and does not require undermining behind the nipple or under the skin. Hence, there is reliable circulation to the nipple-areola complex and skin flaps, and there is less disturbance of the nerve supply to the nipple. The pedicle rotates into position and no pectoral-fascial sutures are needed. Tailor-tacking is used to adjust the skin envelope volume. Minimal or no liposuction is performed.

Cons

Similar to the Lejour technique, Hall-Findlay’s procedure does rely on some postoperative changes to achieve final shape. Initially, the breast may have a “pushed-up” appearance2 and the vertical incision is gathered or bunched, both of which require time for resolution. The superomedial or superolateral pedicles are also less familiar to North Ameri-
can surgeons, who have more experience with inferior pedicle techniques.

**AUTHORS’ PREFERRED TECHNIQUE**

Over the past 3 years, the senior author (Spear) has used a vertical reduction skin excision pattern similar to Hammond’s, but with a superomedial dermoglandular pedicle similar to Hall-Findlay’s. Initial skin markings (Fig. 10) similar to those of the short-scar periareolar inferior pedicle reduction technique are made, and the final vertical scar is closed using a tailor-tacking method. This technique is preferred for small to moderate-sized reductions (<1000 g) in patients with adequate skin elasticity and minimal to moderate ptosis (Figs. 11 through 13). We have found that the excess skin at the inferior aspect of the vertical limb may not adequately settle or retract in the postoperative period. To avoid the potential need for future revision in this area, a short horizontal incision may be used to treat the dog-ear in the operating room. Alternatively, it can be defatted and left to “settle.”

A superomedial dermoglandular pedicle is used to support the nipple-areola complex. Unlike the superior pedicle of the Lassus and Lejour techniques, the posterior chest wall attachment of this pedicle is maintained. The pedicle may also be feathered out laterally along the chest wall, maintaining lateral attachments similar to the inferior pedicle. These attachments, analogous to that of the inferior pedicle or central mound, improve vascularity and innervation to the nipple-areola complex. The superomedial pedicle tends to be shorter in length than the inferior pedicle, which improves vascularity and decreases the amount of deepithelialization required. In addition, the pedicle base location does not interfere with inferior pole skin gathering, as may be encountered during inferiorly based reduction patterns. The superior attachments may also help reduce the incidence of bottoming-out and help maintain fullness superomedially, where it is most desirable.

Patients who require large reductions, have poor skin elasticity, or have significant glandular ptosis are not considered candidates for the vertical skin excision pattern. In those patients,
to adequately reduce the skin envelope, reduce very large breast size, or significantly narrow the breasts on the chest wall, a Wise pattern is used with the same superomedial pedicle. In such cases, the length of the planned horizontal limbs is significantly reduced to shorten the final transverse inframammary scar to fit within the future, shorter inframammary fold.

**Cons**

Currently, this technique involves a long, relatively thin lateral skin flap, which carries a risk of necrosis. In addition, the technique does not currently include any internal shaping with sutures.

**DISCUSSION**

Through review of the various techniques of vertical reduction mammoplasty, it is evident that there is an evolution occurring with this technique. Vertical reduction mammoplasty has evolved to techniques that appear to be of lower risk and have a more immediate and predictable outcome, particularly in the setting of larger breast reductions. The newer techniques of Hall-Findlay, Hammond, and the senior author reviewed above seem to offer improved blood supply and innervation to the nipple-areola complex and improved lactation potential.

The circumvertical techniques described by Hammond and the senior author offer the ability to redistribute the excess breast skin in the periareolar and vertical reduction regions to help keep the resulting scars as short as possible. Although avoiding a transverse scar is the goal of a vertical reduction pattern, a short, tidy transverse scar may be equally or more desirable than a purely vertical scar with irregularities. Furthermore, a vertical scar pattern may not be appropriate in every reduction patient. The larger and more ptotic the breast, the less appropriate vertical techniques become.

Critics of the vertical reduction techniques note that the superior pedicle common to the Lassus and Lejour techniques has a less reliable vascular supply and does not permit significant superior translocation for large reductions. Although Lassus and Lejour do not report a significant incidence of nipple-areola loss, Lassus does recommend limiting superior nipple movement because of potential pedicle kinking. Hammond and Hall-Findlay describe alternative pedicles, compatible with vertical reduction patterns, that maintain the primary arterial source to the breast from the internal mammary perforators.

Similarly, the vertical techniques of Lassus and Lejour also may affect the postoperative innervation to the nipple-areola complex and the potential for lactation. Nipple sensation is primarily derived from the medial and lateral rami of the fourth intercostal nerve with minor contributions from the third and fifth intercostal nerves. Theoretically, those vertical reduction pattern techniques that maintain these sources should offer the greatest degree of postoperative sensation. However, the low incidence of nipple sensory disturbance reported by Lejour following her reduction technique may speak to the relative contribution of the superior cutaneous nerves. Resection of the breast tissue directly posterior to the nipple would be expected to reduce the potential for breast-feeding following reduction. Techniques that maintain the continuity of the lactiferous ducts and a portion of breast tissue posterior to the nipple, in contrast, would be expected to favor postoperative lactation.

**SUMMARY**

Thirty years of experience with vertical reduction techniques suggest that this procedure is a valuable tool in reduction mammoplasty. Recent modifications have been introduced in an effort to simplify the technique and expand the applications of this procedure while minimizing the complications that may be associated with breast reduction techniques. In particular, the superomedial and inferior pedicles are more versatile than superior pedicles of Lejour and Lassus in terms of improved blood supply, innervation, and potential for postoperative lactation. Although a vertical scar pattern is an acceptable method of breast reduction, this technique may not be appropriate for every patient. Knowledge of the various techniques of vertical reduction mammoplasty will allow the surgeon to use the appropriate technique for each individual patient.

Scott L. Spear, M.D.
Division of Plastic Surgery, 1-PHC
Georgetown University
3800 Reservoir Road, N.W.
Washington, D.C. 20007
spears@gunet.georgetown.edu
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REFERENCES


Self-Assessment Examination follows on the next page.
Evolution of the Vertical Reduction Mammaplasty

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1. AN INCREASED RISK OF WHICH OF THE FOLLOWING SEQUELAE IS MOST OFTEN ASSOCIATED WITH THE WISE PATTERN OR INVERTED-T TECHNIQUE OF REDUCTION MAMMAPLASTY?
   A) Nipple ischemia
   B) Nipple numbness
   C) Breast asymmetry
   D) Lower pole bottoming-out
   E) Lateral breast fullness

2. SENSATION IN THE NIPPLE-AREOLA COMPLEX IS PRIMARILY DERIVED FROM BRANCHES OF WHICH OF THE FOLLOWING NERVES?
   A) Third intercostal nerve
   B) Fourth intercostal nerve
   C) Fifth intercostal nerve
   D) Lateral pectoral nerve
   E) Medial pectoral nerve

3. ACCORDING TO LASSUS, WHICH OF THE FOLLOWING IS A CONTRAINDICATION TO THE LASSUS VERTICAL REDUCTION MAMMAPLASTY?
   A) Breast asymmetry
   B) Superior nipple transposition greater than 9 cm
   C) Reduction weight greater than 800 g
   D) Presence of inferior periareolar scar
   E) History of smoking

4. WHICH OF THE FOLLOWING IS NOT A FEATURE OF THE SHORT-SCAR PERIAREOLAR INFERIOR PEDICLE REDUCTION MAMMAPLASTY?
   A) Skin envelope resection
   B) Purse-string periareolar suture
   C) Liposuction for initial volume reduction
   D) Vertical incision tailor-tacking
   E) Inferior pedicle

5. VERTICAL BREAST REDUCTION TECHNIQUES ARE LIMITED TO BREAST REDUCTION VOLUMES LESS THAN 50 G:
   A) True
   B) False

To complete the examination for CME credit, turn to page 946 for instructions and the response form.