Advances in Mastopexy

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*FINANCIAL DISCLOSURE*

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*INTRODUCTION*

The passage of time may result in the loss of skin elasticity and shape of the female breast. Gravity, weight loss, pregnancy, and breastfeeding all may lead to increasingly pendulous ptotic breasts with further loss of firmness, projection, and downward pointing nipples. Many women may express satisfaction with their bra cup size, but still wish to lift the breast in order to restore a more youthful appearance. The challenge remains restoring a more youthful breast and preserving nipple sensation while minimizing complications, side effects, and scars. The four main variations on mastopexy, in order of ascending complexity are primary mastopexy, augmentation/mastopexy, mastopexy after augmentation, and secondary augmentation mastopexy. This chapter will focus on appropriate patient selection and evaluation followed by some of the most current, safe, and effective surgical techniques for mastopexy.

*PATIENT SELECTION AND EVALUATION*

Preoperative evaluation begins with a systematic evaluation of the patient’s ptosis. A thorough history and physical examination includes particular attention to oncologic history and previous breast surgeries. All women as appropriate should undergo baseline mammograms prior to surgery as recommended by published guidelines.

There are a number of variables that may increase the risks of performing a mastopexy, including, but not limited to, smoking, collagen vascular diseases, diabetes, or previous breast surgery such as breast augmentation or breast reduction. Smokers are counseled regarding the increased risk of flap necrosis and are encouraged to stop smoking for a minimum of 2 weeks before surgery. Since the blood supply to the nipple-areola complex is impaired to some extent in such patients, the procedure is performed very carefully with minimal undermining. Previously augmented patients have some degree of inferior pole tissue thinning from the implant and, for the same reason, a cautious and conservative approach is necessary in these patients.

The preoperative evaluation includes an assessment of the size and surface area of the breast, the elasticity of the skin, and quality of the breast parenchyma, as well as the relationship between the nipple, the breast gland, and the inframammary fold. The assessment begins with two key elements: nipple position and its distance from the inframammary fold, as classified by Regnault, and the amount of breast tissue that overhangs the inframammary fold. Using the Regnault classification, breast ptosis is rated as grade 1 ptosis, nipple lying at the inframammary fold; grade 2, nipple below the inframammary fold but still on the anterior portion of the breast; and grade 3 ptosis, where the nipple is at the most inferior portion of the breast (Figure 45-1). Glandular ptosis or pseudoptosis is when a significant amount of the breast tissue falls below the inframammary fold, but the nipple is still located at or above the inframammary fold. Breast ptosis can be a complex problem to describe and solve as it involves more elements than just the relationship between the nipple position and the inframammary fold designated by the Regnault classification. There is a broad spectrum of patients who are possible candidates for mastopexy that have the same Regnault classification, but have very different anatomy and present with very different challenges. For example, a young patient with a small tuberous breast deformity and a Regnault grade 2 ptosis with a short nipple to inframammary fold distance and a tight skin envelope represents an entirely different problem.
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compared with a postpartum woman with C-cup grade 2 ptosis, a long nipple to inframammary fold distance, and loose skin envelope with deflated breasts.

There are four basic situations where patients will request a mastopexy. The first is the patient interested in a bilateral mastopexy for an ample breast plus/minus a small reduction. Principal goals within this patient are to lift and reshape. Second is the unilateral mastopexy performed opposite a reconstruction or nonptotic breast. The goals there focus mainly on achieving improved symmetry. Third is the augmentation/mastopexy, which is intended to enlarge the breast while reducing the skin envelope and moving the nipple. And last is the revision mastopexy, which aims to correct the goals that were not adequately addressed in the primary procedure. All of these factors influence the mastopexy plan and pattern.

\[\text{FIGURE 45-1. Regnault classification: (A, B) breast ptosis is rated as grade 1 ptosis,}
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\[\text{nipple lying at the inframammary fold; (C, D) grade 2 nipple below the inframammary fold}
\]
\[\text{but still on the anterior portion of the breast; and (E, F) grade 3 ptosis, nipple is at the}
\]
\[\text{most inferior portion of the breast.}
\]

\[\text{BILATERAL MASTOPEXY FOR THE AMPLE BREAST}
\]

**Patient Preparation**

The authors’ preferred short scar technique includes a superior pedicle and a vertical skin excision pattern from the nipple extending vertically down to just above the inframammary fold.\textsuperscript{2,3} If required, a small transverse skin excision can be added in the inframammary fold to eliminate any excess skin and dog-ear(s). Creation of glandular flaps and joining medial and lateral pillars narrows and cones the breast, increases projection, and partially contributes to superior pole fullness. Vertical mastopexy incorporates all of these principles, and therefore represents a type of technique, not just a scar pattern.
Planning begins with the patient standing upright. First, draw the midline, breast meridians, and inframammary folds. A line is drawn tangential to the inframammary folds across the front of the chest to the midline for use as a reference. The midline is marked from the sternal notch to the xiphoid process toward the umbilicus. Careful attention is paid to marking the breast meridians, as there are often lateral asymmetries of the nipple-areola complex that might be improved by adjusting the planned excision (Figure 45-2).

The degree of ptosis is then evaluated noting the relationship of the nipple to the inframammary fold, the distance between the nipple and inframammary fold, and the volume of breast that overhangs the fold. The distance from the nipple to the inframammary fold is measured with the skin placed on tension to simulate the stretch that will be caused after skin excision. Sternal notch to nipple distance differs among patients with different heights, and as such, the absolute numerical measurement is not as helpful as the previously mentioned measurements. However, the nipple to inframammary fold distance is used as a guide to assess symmetry of the nipple-areola complex in each patient. Based on these measurements, an appropriate excision pattern is planned. First, superomedial traction is applied to the breast and vertical marks are drawn on the lateral surface of the breast skin over the projected breast meridian. Next, superolateral traction is applied to the breast and similar vertical marks are drawn on the medial surface of the skin over the projected breast meridian. The key to marking the pillars is estimating how much the medial and lateral portions of the breast can be mobilized to the breast meridian (Figure 45-3). These markings extend from the circumareola marks and join in a V or U shape just above the inframammary fold. These lines are then pinched together to check if skin closure is possible. The length of the vertical limb is directly related to the amount of ptosis, but never extends beyond the inframammary fold. If there is significant asymmetry between the two breasts, it follows that the planned skin excisions may be different. It is made clear to the patient before surgery that while the intent of the procedure is to achieve a more symmetrical result, perfect symmetry is never achieved.

As part of the initial skin marking in the examination room, the nipple-areola complex is manually stretched superiorly and tailor-tacked with the examiners finger tips so that the upper border of the planned new areola position can be marked on the chest with the nipple at or slightly below the center of the projected dimensions of the breast mound (Figure 45-2). Gentle downward traction is placed simultaneously on the superior pole breast skin to simulate the tension that will be created by the mastopexy. It is important to note that the vertical component of the excision will reduce the diameter of the circumareola aperture by a distance measuring approximately one third of the width of the vertical excision (circumference = π × diameter). It is this reduction in width which helps cone and project the breast.

Operative Technique

Circumvertical Technique. The procedure itself begins with the patient in the supine position with arms tucked or abducted less than 90 degrees. Be sure not to over abduct the arms in order to minimize the risk of any nerve injury. Pad both hands, elbows, and any other pressure points. A 38 or 42 mm cookie cutter is centered over each nipple without undue tension on the skin. After de-epithelializing the skin between the reduced areola and the outside border of the new areola window, the outer circumference of the dermis is incised, ensuring the incision is about 5 to 7 mm away from the skin edge in order to leave an adequate dermal cuff in which to place a purse-string suture if desired. Skin edges may be conservatively undermined.
(approx. 0.5 cm thickness) from the glandular tissue to minimize skin retraction and aid in closure.

Along the vertical component, after the skin incision is made, the skin is de-epithelialized or removed as marked. A decision at this moment must be made whether to imbricate the breast or mobilize flaps based medially and/or laterally. Our preference is to split the lower pole of the breast along or near the medial edge of the window created by the inferior skin excision, thus allowing the mobilization of all the exposed breast tissue on a laterally based flap. The lower pole breast tissue is elevated inferiorly at the level of the pectoralis fascia. This leaves the nipple-areola complex on a superiorly based pedicle. The central portion of the inferior pole may either be resected or included as part of the lateral and/or medial flaps. De Mey et al. noted a critical length of the pillars to be an average of 7 cm from inferior border of the areola to inframammary fold.4

In their technique, Graf and Biggs advocate the use of a pectoralis muscle sling to act as support and minimize breast ptosis recurrence.5 Their technique involves the creation of three flaps: a centrally/inferiorly chest wall-based flap and medial and lateral pillars. The central flap is attached superiorly and held in place by a bipedicled loop of pectoral muscle over which the medial and lateral pillars are closed. Ritz et al.6 similarly describe using a bipedicled pectoral fascia flap to hold an inferiorly pedicled flap. Unfortunately, these techniques do violate the pectoralis muscle and fascia which may raise oncologic concerns when performing lumpectomy, mastectomy, or even radiographic studies. Additionally, we have found that the central flap is not actually truly inferiorly based and adequately mobilizing the flap off of the chest wall may additionally compromise its blood supply.

We do, however, find the creation of glandular flaps to be a very powerful tool, but we prefer a different approach. We too mobilize and attach glandular tissue to the chest wall in a retro glandular space, which serves to augment projection. We do this by recruiting tissue based on a lateral flap (Figure 45-4). Absorbable sutures...
placed high on the chest attach this flap to the pectoralis fascia to overcorrect the lift and compensate for postoperative settling. The lateral flap is mobilized and rotated/advanced superomedially to fill out the central region of the breast behind and above the nipple-areola. The medial glandular pillar is then approximated to the base of the lateral flap. Plication of the pillars from the inframammary fold to just below the areola is then performed in a vertical fashion to cone the breast. Excess skin may be evenly distributed along the entire vertical incision. If there is too much excess tissue to be absorbed by the vertical incision, the skin generated at the lower pole may be drawn together in a purse string. Alternatively, any residual dog-ear may be excised leaving a small transverse scar in the inframammary fold. No matter what, the final vertical scar should be entirely contained above the inframammary fold. To counteract unavoidable settling, the superior pole should be overly full in relation to the inferior pole at the end of the procedure.

Final nipple position should be in the vicinity of the apex of the breast. If the circumference of the new areola risks being significantly larger than desired, a “blocking” suture can be used by purse-stringing the dermal cuff with a permanent 3-0 or 4-0 suture. We have adopted the interlocking Gore-Tex suture technique described by Hammond for that purpose (Figure 45-5). Finally, the skin is closed with interrupted and running buried absorbable monofilament suture (Figure 45-6).

**Wise Pattern Technique.** The inverted T skin pattern remains the most commonly performed type of mastopexy in the United States. We believe that in the vast majority of cases, a circumvertical technique is sufficient, leaving a formal Wise pattern only to be used to treat the most severe grades of ptosis such as in the massive weight loss patient.
Preoperative evaluation and markings proceed similar to a short scar mastopexy with the following exceptions: (1) the horizontal component of the skin pattern is placed at the level of the inframammary fold and the final skin closure should remain within this position (Figure 45-7); (2) after skin incisions have been performed, dissection may proceed with either a superior, superomedial, inferior, or central pedicle to supply the nipple-areola complex; and (3) medial and lateral pillars consisting of skin and breast parenchyma are then elevated just above the level of the pectoralis fascia for advancement or transposition, as described in the circumvertical technique. Excess tissue may be trimmed from the cut edge of the lateral flap and/or from the inferior aspect of both flaps.
Once the vertical and horizontal limbs are sutured closed, the nipple is inset at the apex of the keyhole pattern approximately 5 to 7 cm superior to the inframammary fold.

**Concentric Technique.** When planning the mastopexy pattern, a concentric pattern may at first seem desirable with respect to limiting the amount of scars placed on the breast; however, this is at the cost of placing more tension on the closure and may lead to a flattened breast, poor scarring, and/or a distorted nipple-areola complex, and is not advised for a mastopexy alone. A circumvertical excision pattern increases projection by narrowing and coning the breast and provides the most control in terms of shaping the breast. Even in situations where an acceptable result using a concentric pattern could be achieved, we will often add a conservative vertical excision to improve the overall shape of the breast.

We rarely perform an isolated concentric mastopexy. The most common indications for concentric mastopexy are for attempting to match a reconstructed breast, gynecomastia, and unilateral or bilateral mastopexies done for asymmetry in conjunction with breast augmentation (Figure 45-8). Concentric mastopexy may also be successful when combined with implant explantation. It should not be attempted for substantial grade 2 or 3 ptosis.

**AUGMENTATION/MASTOPEXY**

The single-stage augmentation/mastopexy has the unenviable distinction as one of the most litigated procedures in plastic surgery. An increased risk of skin and nipple necrosis, distortion of the nipple-areola complex, poor scarring, and even implant extrusion results from an increasingly compromised blood supply and greater stress on the closure.

The inherent risks of this procedure have not affected its popularity among patients. Between 1997 and 2007, there has been a 395% increase in the frequency of breast augmentation and an equal increase in breast lift procedures. The number of combined augmentation/mastopexy procedures has similarly increased in frequency because of the convenience of a single-stage operation. We have previously written extensively on the subject of augmentation/mastopexy.
FIGURE 45-7. The standard Wise pattern skin excision pattern may be drawn one of two ways. (A) An inverted V is drawn with vertical limbs measuring between 9 and 11 cm. Later in the procedure, the nipple is externalized at the apex of the design. (B) A keyhole may be incorporated into the initial markings with vertical limbs measuring 5 to 7 cm. Note essential limb measurements: segment $AB$ should be $\geq BC$, and segment $DE$ should be $\geq CE$.

FIGURE 45-8. Preoperative markings for the concentric mastopexy include the inframammary fold; (A) the superior extent of the excision, representing the new superior edge of the areola; (B) approximately 6 cm up from the inframammary fold, marked as needed to correct glandular ptosis; (C) 8 to 10 cm from the midline, marked as needed to leave adequate medial breast skin; and (D) the lateral extent of the incision, marked also to leave the desired amount of lateral breast skin. (Reprinted with permission from Spear SL, Giese SY, Ducic I. Concentric mastopexy revisited. Plast Reconstr Surg. 2001;107(5):1294–1299.)
A single-stage procedure may seem attractive to both surgeon and patient, but its successful execution is contingent upon careful preoperative planning and attentive implementation to reduce the severity and frequency of complications. If the primary goal is to correct significant asymmetries, particularly if this involves a significant reduction or a reduction/mastopexy procedure on one side, the safest plan may be to perform the mastopexies first followed by breast augmentation at a second stage. Attempting to account for too many variables in one setting may lead to unpredictable and disappointing results.

Our approach to augmentation mastopexy is focused around several principles: placing the implants first and then tailoring the skin envelope to accommodate the larger breast volume, addressing breast asymmetries by employing different mastopexy patterns when appropriate, tailor-tacking the skin with the patient in the upright position in the operating room prior to committing to the planned mastopexy pattern, and conservative superficial undermining of the skin to preserve perfusion to the nipple-areola complex and to reduce wound healing complications.

**Patient Preparation**

When evaluating a patient for augmentation/mastopexy, several key factors should be taken into account. An implant alone may be sufficient to address some mild forms of ptosis. However, the more the skin and glandular tissue overhangs the inframammary fold, the less likely an implant will be able to completely fill out the breast in a cosmetically acceptable fashion unless skin is excised. Similarly, the lower the nipple, the less likely a prosthesis will raise the nipple adequately onto the surface of the breast. In these cases, the circumareola or vertical technique are most helpful for addressing a greater degree of ptosis.

After evaluating the degree of breast and nipple ptosis and forming an operative plan, measurements for the implant are made. The base width of the breast is measured as well as the superior pole pinch thickness. The difference between these values is used as a guide to determine the upper limit for the diameter of the implant. Using the implant diameter measurement, the height of anticipated breast is marked from the inframammary fold. Markings are made to visualize the implant position on the chest wall and predict appropriate nipple placement.

Unlike breast reduction procedures, the nipple-areola complex is invariably marked to lie somewhere above the inframammary fold in augmentation/mastopexy. While the most serious error is to place the nipple too high, the most common error is inadequate elevation of the nipple. It is important to note the presence of tan lines. Citing the upper border of the areola needs to take these borders into consideration. It is also useful to have the patient wear a bra and mark the upper boundaries of the breast that the bra covers. These maneuvers can serve as important guides to avoid placing the nipple too high. As a general principle, the final extent and pattern of the excision should not be committed to until the implants are placed. The skin envelope and nipple position are then tailor-tacked with the patient sitting upright and then adjusted to the dimensions of the newly augmented breast. Only then is the final nipple position determined.

The decision-making process in selecting the appropriately sized implant is more complex in one-stage augmentation mastopexy than staged augmentation after mastopexy alone. Because the skin envelope will be reduced, it is important to measure not only the base width of the breast in its native state, but also the base width while tailor-tacking the skin to simulate the breast dimensions after mastopexy. This will effectively narrow the base width and provides a closer approximation of what the outer limits of the implant diameter should be. For example, if the breast is 14 cm wide with a 2 cm pinch thickness and has a base width of 13 cm when simulating the mastopexy, then an implant diameter of 11 cm might be more appropriate than one with a diameter of 12 cm. In terms of implant projection, for deflated breasts, we prefer the higher profile models to fill out the loose skin envelope. Once these parameters are defined, a discussion with the patient regarding her ideal breast size refines the final choice of implant.

**Augmentation/Mastopexy Technique**

A concentric mastopexy for augmentation/mastopexy works well for a patient where the nipple lies near or just below the inframammary fold with the inferior border of the areola no lower than the inferior curve of the breast on frontal view, and where there is less than 4 cm of breast overhanging the inframammary fold, leaving an initial nipple to inframammary fold distance of no more than 9 cm (Figures 45-9 and 45-10). In planning a circumareola mastopexy, as a guideline, the ratio of the outer to the inner diameter of the circumareola markings should ideally be no greater than 2:1 and certainly no greater than 3:1. A periareola augmentation/mastopexy must take into account the implant’s tendency to dilate the areola while filling out the native breast skin and increasing breast volume. The ideal scenarios for periareola mastopexy and augmentation are (1) the areola being too large preoperatively, (2) the nipple and/or breast being too ptotic for correction with an implant alone, and (3) the breast(s) being tuberous.

The short scar technique is appropriate for the majority of patients with a moderate amount of ptosis (Figure 45-11). In patients where it is unclear whether any mastopexy procedure will be necessary, the procedure begins with a periareola incision for placement of the implant without any de-epithelialization. The incision is usually made along the inferior border of the areola and dissection is carried down to the pectoralis major muscle. If the ptosis is severe and the surgeon is confident that a vertical technique is required, then the safest
way to enter the breast is in a vertical manner within the planned area of de-epithelialization. Theoretically, this dissection would be parallel to the neurovascular supply to the nipple. However, if there is any question regarding the need for a vertical excision, then a periareola approach is used.

At our institution, we prefer a dual-plane approach when placing the implant partially retropectorally. The inferior third of the pocket is dissected in the subglandular plane while the upper two thirds or so of the pocket lies in the subpectoral plane. Meticulous hemostasis and irrigation with a triple-antibiotic solution are routinely performed to minimize the risk of capsular contracture or infection. After completing the dissection, the implant is soaked in antibiotic solution, the field is re-prepped with a Betadine paint stick, and gloves are changed prior to implant placement. After the insertion of the implant, the incision is stapled closed and the patient is positioned sitting fully upright.

The design is tailor-tacked with the patient sitting upright once the implant is in place. Only then is de-epithelialization performed as necessary. The strategy should be to avoid making unnecessary scars on the breast in borderline cases. Minimal undermining in the subcutaneous plane is performed to re-drape the skin. Care is taken not to dissect deep and violate the breast parenchyma in order to preserve blood supply to the nipple. Usually only 1 to 2 cm of undermining is required. The amount of excess skin that can safely be removed is now more accurately determined. These areas are de-epithelialized and then minimal subcutaneous undermining is performed around the areola after incising the dermis leaving a 5 to 7 mm dermal cuff. The vertical closure is usually 6 to 8 cm in length, depending on the implant and final total breast size. Greater vertical lengths are addressed with small transverse triangular excisions based at the inframammary fold. Sometimes, a small amount of excision of breast tissue is required both in the vertical and transverse components of the design. Note that these maneuvers should be conservative as they increase the risk of implant exposure and vascular compromise. All incisions are then closed using buried interrupted
**FIGURE 45-10.** (A,B) Preoperative view of a 37-year-old woman with second-degree ptosis and breast asymmetry. (C) Preoperative markings. (D–F) Postoperative view, 9 months after undergoing bilateral augmentation with 240-cc silicone implants and bilateral concentric mastopexies.
and running Monocryl suture. The nipple position is then reassessed and remeasured and may be fine-tuned as required. Finally, the skin is closed with interrupted and running buried Monocryl suture. All patients are placed in a soft bra and followed closely in the first few days to monitor the nipple and flaps.

**COMPLICATIONS**

Regardless of the pattern used, each can be associated with potential complications. Inappropriate use of the concentric excision can lead to poor scarring, areola distortion, and flattening of the breast may occur. Lejour found that in her experience of 152 consecutive circumvertical mastopexy...
patients, complications included four seromas, six hematomas, and one infection.27

A malpositioned nipple-areola complex is usually the result of unsuccessful preoperative planning and/or committing to the planned excision without intraoperative tailor-tacking. These maneuvers are critical because it is not always possible to accurately predict the new dimensions of the breast once the implant is placed. Most commonly, the nipple is inadequately raised, which can be addressed with a simple revision. However, a nipple-areola that is too high is a more difficult problem because surgical correction is difficult and may leave the patient with a visible scar in the superior pole of the breast—a scar that may be visible in a swimsuit or low-cut dress (Figure 45-12). More dreaded than the malpositioned nipple is frank nipple necrosis (Figure 45-13).

In patients who have previously undergone breast reduction, the risks may be significant. In secondary cases, when in doubt, the mastopexy may be performed using de-epithelialization only, without undermining the skin. If re-draping is necessary, undermining should always be performed conservatively (1–2 cm) in a superficial subcutaneous plane.

Specifically, with regard to the augmentation/mastopexy patient, these procedures have a higher rate of complication. A review from 1993 to 2001 yielded 34 consecutive revision augmentation/mastopexies with the most common problems being recurrent ptosis (55%), capsular contracture (55%), implant malposition (35%),
FIGURE 45-14. (A,B) Preoperative view of a 42-year-old woman who presented 11 years after breast augmentation with subglandular saline implants complaining of droopiness and upper pole emptiness. She has 36C cup breasts and second-degree ptosis with asymmetry. (C) Preoperative markings for a circumvertical mastopexy with augmentation. (D) Intraoperative view of initial de-epithelialization of design.  
(E) Placement of strattice as an interpositional graft by parachuting. (F) Strattice in place with no ripples.
size change (30%), poor scars (25%), and nipple malposition (10%), and an average interval to revision of 7 years. If these complications occur, revision surgery can often be very challenging and may require incorporating acellular dermal matrix into revisionary augmentation/mastopexy for capsular contracture, rippling, implant malposition, and reinforcing thinned breast tissues from large breast implants (Figure 45-14). The benefits of acellular dermal matrix include improved control and support of implant position, and better implant coverage. In cases of difficult and recurrent capsular contracture, acellular dermal matrix may be inset as a large interpositional graft.

CONCLUSION

Mastopexy can be a safe and gratifying procedure for both patient and surgeon when performed with thoughtful planning and careful execution. Patients should be well-informed preoperatively that breast asymmetries may be improved upon but is rarely completely corrected. A symmetric approach is preferred for mild asymmetries while different excision patterns may be required for significant asymmetries. Nipple-areola malposition may be avoided by careful intraoperative tailor tacking. Safe and successful surgeries can be reliably achieved for both mastopexy and augmentation/mastopexy with adherence to these principles.

REFERENCES


