Augmentation/mastopexy when performed in a single stage presents more significant challenges than either augmentation or mastopexy alone. The combination of breast augmentation and mastopexy in one stage exponentially increases the risk of complications than either surgery carries alone.\(^1\)–\(^3\) Its reputation within plastic surgery as a significant source of litigation is well established.\(^4\) The complexity of a one-stage augmentation/mastopexy is a result of combining the expansion of breast volume while at the same time reducing the skin envelope, effectively two opposing goals.\(^5\) As a one-stage procedure, augmentation/mastopexy is associated with all of the risks of breast augmentation and mastopexy, including nipple malposition, inadequate ptosis correction, misshapened areolas, poor scarring, capsular contracture, and implant malposition. Theoretically, increased risks and uncertainties also include wound healing problems, skin necrosis, implant extrusion, infection, and misalignment of the nipple, gland, and implant. Although loss of the nipple is not a risk typically associated with either mastopexy or augmentation alone, it is a risk of augmentation/mastopexy when the two operations are combined.

The inherent risks of this procedure have not affected its popularity among patients. Between 1997 and 2007, there was a 395% increase in the frequency of breast augmentation and an equal increase in breast lift procedures.\(^6\) The number of combined augmentation/mastopexy procedures has similarly increased in frequency because of the convenience of a single-stage operation. The authors have previously written extensively on the subject of augmentation/mastopexy.\(^7\)–\(^14\) A review from 2003 to 2006 comparing our experience with breast augmentation, primary augmentation/mastopexy, and secondary/augmentation mastopexy revealed complication rates of 1.7%, 17%, and 23%, respectively.\(^14\)

To better understand why approximately 20% of the combined procedures have revisions or complications, we reviewed the most common complications and causes for revision in a separate publication.\(^11\) This separate series of 34 consecutive revisions after previous augmentation and mastopexy from 1993 to 2001 demonstrated that the most common features of patients having revisions were recurrent ptosis (55%), capsular contracture (55%), implant malposition (35%), size change (30%), poor scars (25%), and nipple malposition (10%). These percentages represent those patients having revision and are not the percent of revisions of the group of augmentation/mastopexies seen as a whole. These revisions were performed after an average interval of 7 years from the previous surgery.

Although a single-stage procedure remains attractive to the surgeon and patient, its successful execution is contingent upon careful preoperative planning and attentive implementation to reduce the severity and frequency of complications. The following discussion is a detailed description of our approach to augmentation/mastopexy, which is focused around several principles as follows:

In most cases, 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 before finally committing to the planned mastopexy pattern
Conservative superficial undermining of the skin to preserve perfusion to the nipple-areola complex (NAC) and skin flaps to reduce the risk of necrosis and wound healing complications

PATIENT SELECTION AND EVALUATION

A broad spectrum of patients who are candidates for augmentation/mastopexy exists who present with very different challenges. A young patient with a tuberous breast deformity and a short nipple to inframammary fold distance with a tight skin envelope presents with an entirely different problem than a postpartum woman with deflated breasts and loose skin. These factors influence the size and dimensions of the implant and the mastopexy pattern. The decision of whether to perform a mastopexy and with what type of skin excision pattern is dependent upon the size of the breast and the surface area of the skin envelope. Critical to this decision is the relationship among the nipple position, breast parenchyma, and inframammary fold.

The preoperative evaluation begins with a systematic evaluation of the patient’s ptosis. Using the Regnault classification, breast ptosis is rated as grade I, nipple lying at the fold; grade II, nipple below the fold but still on the anterior portion of the breast; or grade III, nipple at the most inferior portion of the breast (Fig. 1). Breast ptosis can be a complex entity that involves more elements than the relationship between the nipple position and the inframammary fold as designated by the Regnault classification. Several other factors should also be taken into consideration before surgery, including the patient’s primary motivation.

If breast augmentation is the primary goal, some ptosis may be camouflaged by placing an implant alone, provided that the size of the implant is sufficient to fill out the patient’s skin envelope. In the authors’ experience, a mastopexy may not be required if there is less than 2 cm of breast overhanging the fold and the nipple is positioned on the anterior surface of the breast, with nonpigmented skin visible between the areola and the inferior border of the breast and a nipple to inframammary fold distance that is not excessively long (<9 cm). If the primary goal is to correct significant asymmetries, particularly if this involves a significant amount of reduction on one side, the safest plan may be to perform the mastopexies first followed by breast augmentation at a second stage. Accounting for too many variables in one setting may lead to unpredictable and often disappointing results.

The preoperative evaluation also includes an assessment of the size and surface area of the breast, the elasticity of the skin and the quality of the breast parenchyma, as well as the relationship among the nipple, breast gland, and inframammary fold (Figs. 2–4). The assessment begins with two key elements: (1) the nipple position in relation to the inframammary fold, as classified by Regnault, and (2) the vertical distance that the breast overhangs the fold. Next, 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 when the implant is placed. The more the skin and glandular tissue overhangs the inframammary fold, the less likely that a reasonable size implant alone will be able to successfully fill out the breast. Similarly, the lower the nipple on the surface of the breast, the less likely a prosthesis will elevate the nipple adequately onto the surface of the breast.

When planning the mastopexy pattern, a circumareolar pattern may be more desirable with respect to limiting the amount of scars placed on the breast, but this comes at the cost of placing more tension on the closure and may lead to a flattened appearance, poor scarring, or a distorted NAC. In the vast majority of cases, a circumareolar or, more commonly, a vertical or circumvertical technique is sufficient, leaving a formal “Wise” pattern for only the most severe cases. A circumareolar mastopexy alone works well only for the patient in whom the nipple lies near or just below the fold with the inferior border of the areola no lower than the inferior curve of the breast on frontal view, and when there is less than 4 cm of breast overhanging the fold, leaving an initial nipple-to-fold distance of no more than 8 to 9 cm. In planning a circumareolar mastopexy, as a guideline, the ratio of the outer to the inner diameter of the circumareolar markings should ideally be no greater than 2:1 and certainly no greater than 3:1.

The circumvertical or vertical technique offers the greatest versatility and is most helpful when there is a greater degree of ptosis. This technique is most appropriate when the nipple is more than 2 cm below the inframammary fold, a portion of the areola lies on the inferior curve of the breast, the nipple-to-fold distance is greater than 8 or 9 cm, or the breast overhangs the fold by 4 or more cm. Adding a vertical component to
the excision pattern effectively reduces the diameter of the circumareolar closure by approximately one third the distance of the width of the vertical excision (circumference = π D). A circumvertical excision pattern not only places less tension on the circumareolar closure but also increases projection by narrowing and coning the breast. For these reasons, a circumvertical pattern provides the most control in terms of shaping the breast. Even in situations in which an acceptable result using a circumareolar pattern might be achieved, we will often add a conservative vertical excision to improve the overall shape of the breast.

As a general principle, the final extent and pattern of the excision should not be determined until the implants are placed. The skin envelope and nipple position are then tailor-tacked with the patient sitting upright and then finally adjusted to the dimensions of the newly augmented breast. A transverse scar may be added to keep the nipple to inframammary fold distance from getting too long. The addition of a transverse scar does not
invalidate the circumvertical approach to the procedure.

**PREOPERATIVE HISTORY AND CONSIDERATIONS**

Several variables may increase the risks of performing a single-stage augmentation/mastopexy, including smoking or a previously performed breast augmentation or breast reduction. Smokers are counseled as to the increased risk and are cautioned to stop smoking. Because the blood supply to the NAC is impaired to some extent in all of these patients, the procedure is performed carefully with minimal undermining. Previously augmented patients have some degree of thinning of the tissues from the implant, and, for the same reasons, a cautious and conservative approach is necessary.

**CHOOSING THE IMPLANT**

The decision-making process in selecting the appropriate sized implant is more complex in augmentation/mastopexy than in augmentation alone. Because the skin envelope will be reduced, one should measure not only the base width of the breast in its native state but also the base width while pinching the skin to simulate the breast dimensions after the mastopexy (Fig. 5). This maneuver 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 13 cm wide with a 2-cm pinch thickness and has a width of 12 cm when simulating the mastopexy, an implant diameter of 10 to 11 cm would probably be more appropriate than one with a diameter of 11 to 12 cm. In terms of implant projection, for deflated breasts, the higher profile models are often preferable in filling 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.

**Preoperative Markings**

With the patient standing upright, markings begin with the midline, breast meridians, and inframammary folds (see Fig. 2). A line is drawn tangent to the inframammary folds across the front of the chest for use as a reference for the inframammary lines; in this patient, the nipple falls at the level of the fold. Careful attention is paid to marking the breast meridians because there are often lateral asymmetries of the NAC that should be corrected as much as possible by adjusting the planned excision.

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The degree of ptosis is then evaluated, noting the relationship of the nipple to the inframammary fold as well as the nipple-to-fold distance and the amount or volume of breast that overhangs the fold. The sternal notch-to-nipple distance is variable among patients with different heights; therefore, the absolute numerical measurement is not as helpful as the previously mentioned measurements. Nevertheless, it can be used as a guide to assess symmetry of the NAC in each patient. Based on these measurements, a preliminary decision is made in regards to whether to proceed with a mastopexy and, if so, which type to use. If there is significant asymmetry between the two breasts, logic follows that planned skin excisions may be different, and it is made clear to the patient that although the intent is to achieve a more symmetric result, perfect symmetry virtually never happens.
After evaluating the degree of breast and nipple ptosis and forming an initial operative plan, measurements for the implant are made. The base width of the breast is measured at rest and while simulating the mastopexy with a vertical pinch between the surgeon’s thumb and fingers (see Fig. 5). The upper pole pinch thickness is also measured with calipers. The difference between these values is a guide to the upper limit for the diameter of the implant. Using the implant Fig. 3.

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 when the implant is placed. The medial and lateral pillars of the vertical mastopexy component are marked while displacing the breast medially and laterally, respectively.

Fig. 4. (Left) Distance of the nipple off the midline is measured. This value generally ranges from 8.5 to 10 cm. (Right) Nipple width distance is then evened out. Note asymmetric areolar windows of this patient, 7.5 cm versus 6.5 cm, to correct breast asymmetries.
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.

As part of the initial skin marking in the examination room, the NAC is manually pinched and tailor-tacked 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. Gentle downward traction is placed on the superior pole breast skin to simulate the tension that will be created by the mastopexy. Unlike in breast reduction procedures, the NAC is invariably finally marked to lie somewhere above the inframammary fold in augmentation/mastopexy once the implant is in. Although 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, because these are another guide to areas that may be exposed in swimwear or some clothing. It is also useful to have the patient wear a bra and mark the upper boundaries of where the bra crosses the breast. These maneuvers can serve as important guides to avoid placing the nipple too high. Ultimately, the final nipple position is still best decided intraoperatively after placement of the implant, tailor-tacking the planned excision, and sitting the patient upright.

Circumareolar Technique

Starting from the planned new upper areolar border and skirting the edges of the NAC, an ellipse is drawn around the lower half of the areola. A total of 5 to 7 cm of skin should be left between the bottom of this ellipse and the fold. Measurements are taken from the midline to the medial edge of the markings on both sides to help provide reasonably symmetric placement of the NAC on the vertical axis. If significant asymmetry exists, the side with the relatively malpositioned NAC is addressed by adjusting the medial or, less often, the lateral extent of the ellipse. Finally, the nipple-to-fold distance is measured again to ensure symmetry of the NAC in the transverse plane (Fig. 6).

The procedure begins with the patient in the supine position with the arms tucked or abducted 90 degrees or less. Careful attention is made to padding at the hands and elbows. A 42-mm cookie cutter or other diameter circle is centered over each nipple without undue tension on the skin. In patients in whom it is unclear whether any mastopexy procedure will be necessary, the procedure begins with a periareolar 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.

Fig. 5. (Left) Because the skin envelope will be reduced, it is important to measure not only the base width of the breast in its native state, (Right) but also the base width while tailor-tacking the skin to simulate the breast dimensions after the mastopexy. The base width is narrowed and will require a smaller diameter implant based on the new width. Note red dot denotes new nipple position.

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At the authors’ center, we prefer a dual-plane approach placing the implant partially retropectoral-ly.20 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.21 After completing the dissection and irrigation, the implant is soaked in antibiotic solution, the field is re-prepped with a Betadine paint stick, and gloves are changed before implant placement. After the insertion of the implant, the incision is stapled closed, and the patient is positioned sitting fully upright. If significant ptosis remains, the previously planned circumareolar pattern is tailor-tacked using a skin stapler. The nipple position is then reassessed and re-measured and may be fine-tuned as required. The placement of an implant alone will often create the appearance that the nipple has been elevated 2 cm or more. Circumareolar de-epithelialization may then be performed as necessary. This strategy may avoid unnecessary placement of scars on the breast in borderline cases.22,23

After de-epithelialization, the outer circumference of the dermis is incised with the Bovie on cutting mode, ensuring that the incision is about 5 to 7 mm away from the skin edge leaving a dermal cuff. Minimal undermining in the subcutaneous plane is performed to redrape the skin. Care is taken not to dissect deep and violate the breast parenchyma to preserve blood supply to the nipple. Usually, only 1 to 2 cm of undermining is

**Fig. 6.** Patient with all preliminary markings in repose (left) and with arms raised (right) to demonstrate planned areolar windows, vertical excisions, and inframammary folds. Note planned nipple placement (red dot) at approximately +3 cm superior to inframammary folds.

**Augmentation Mastopexy**

**Fig. 7.** (Left) The interlocking Gore-tex suture technique described by Hammond. Using a CV-3 Gore-tex suture, eight equally spaced bites are placed between the dermal cuff and the dermis of the NAC. Note nipple skin closure after purse-string on contralateral breast. (Right) Close-up view of right breast.
required. Classically, a “blocking” technique is used by purse-stringing the dermal cuff with a permanent 3-0 suture. More recently, the authors have adopted the interlocking Gore-Tex suture technique described by Hammond. Using a CV-3 Gore-Tex suture, eight equally spaced bites are placed between the dermal cuff and the dermis of the NAC (Fig. 7). The skin is closed with interrupted and running buried Monocryl sutures.

Circumvertical Technique

The circumvertical technique is similar to the periareolar approach but includes a vertical skin excision from the nipple and extends vertically down to or just above the inframammary fold. If required, a small transverse skin excision placed in the inframammary fold is performed to eliminate any dog ear and to avoid leaving too much skin inferiorly from the nipple to the fold. This maneuver allows for coning of the breast in cases where greater skin excision is necessary.

The preliminary markings and nipple position are determined as previously described. Superomedial and superolateral traction is applied to the breast, and vertical marks are drawn on the surface of the skin over the projected breast meridian (see Fig. 3). These markings extend from the circumareolar marks and join in a “V” or “U” shape down to or just above the fold. These lines are then pinched together to check whether skin closure is possible while anticipating the effect of the implant (see Fig. 5). The length of the vertical limb is directly related to the amount of ptosis but never extends beyond the inframammary fold. If necessary, after tailor-tacking, any residual dog ear can be excised, leaving a small transverse scar in the inframammary fold.

Tailor-tacking is particularly important at this portion of the procedure and should precede any committed excisions of the planned skin design. If the ptosis is severe and the surgeon is confident that a vertical technique is required, 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, a periareolar approach is used.

The design is tailor-tacked with the patient sitting upright once the implant is in place. The amount of excess skin that can safely be removed is now more accurately determined. These areas are de-epithelialized, and 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 excision of excess breast tissue is required in the vertical and transverse components of the design. These maneuvers should be conservative because

Fig. 8. (Left) Preoperative views of the 45-year-old woman seen in previous figures. She had 34B cup breasts and second-degree ptosis with asymmetry. (Right) Postoperative view 3 weeks after undergoing bilateral augmentation with Allergan Style 120 textured round silicone gel 400 mL implants with circumvertical mastopexies.
Fig. 9. (Above, left) Preoperative view of a 32-year-old woman who lost 100 pounds through exercise and diet. She had 34C cup breasts and second-degree ptosis with asymmetry. (Above, right) Postoperative view 6 weeks after undergoing bilateral augmentation with 280 cc silicone implants with bilateral vertical mastopexies. Despite improvement, the patient desired to be fuller superiorly with more lift. (Below, left) Preoperative plan for revision surgery. (Below, right) Postoperative view 3 months after undergoing reaugmentation with 500 cc silicone implants and revision vertical mastopexy. (From Spear SL, Boehmler JH, Clemens MW. Augmentation/mastopexy: a 3-year review of a single surgeon’s practice. Plast Reconstr Surg 2006;118: 136S–47S; with permission.)

Fig. 10. (Left) Preoperative view of a 33-year-old woman who previously had a child and sustained involutional changes in her breasts. She had 32B cup breasts and second-degree ptosis with asymmetry. (Right) Postoperative view 4 months after undergoing bilateral augmentation with Allergan right 450 cc and left 425 cc smooth round silicone implants with bilateral circumareolar mastopexies.
they increase the risk of implant exposure and vascular compromise. All incisions are then closed using buried interrupted and running Monocryl sutures. If the circumareolar area of excision is significant, the interlocking Gore-tex suture technique may be used for added stability even with the vertical technique. Patient examples at different follow-up time points are shown in Figs. 8–11.

COMPLICATIONS AND SIDE EFFECTS

The most common sources of litigation in augmentation/mastopexy include inappropriate use of the circumareolar excision pattern and nipple malposition. When used too aggressively, poor scarring, areolar distortion, and flattening of the breast may occur. To avoid these potential problems, when in doubt, the surgeon should use a circumvertical pattern, especially when the ratio of the outer to inner circumareolar diameter is larger than 3:1.

A malpositioned NAC is usually the result of poor preoperative planning or committing to the planned excision without intraoperative tailoring. 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. A NAC 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 that may be visible in a swimsuit or low-cut dress.

Perhaps the most dreaded complication is nipple necrosis. In patients who have previously undergone breast reduction, mastopexy, or augmentation, 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 redraping is necessary, undermining should always be performed conservatively (1 to 2 cm) in a superficial subcutaneous plane.

POSTOPERATIVE CARE

Patients are placed in a soft bra and observed closely in the first few days to monitor the nipple and flaps.

SUMMARY

Augmentation/mastopexy can be a safe and gratifying procedure for the patient and surgeon when performed with thoughtful planning and careful execution. Patients should be well informed preoperatively that breast asymmetries may be improved but are never completely corrected. A symmetric approach is often appropriate for mild asymmetries, whereas different excision patterns may be required for significant asymmetries. Care must always be taken in the extent of

Fig. 11. (Upper left) Preoperative view of a 33-year-old woman with 34C cup breasts, second-degree ptosis of both nipples, and breast glands with asymmetry. (Upper right) Preoperative markings. (Bottom) View of the patient 8 months after undergoing bilateral augmentation with Allergan Style 68 left 250 cc and right 270 cc smooth round saline implants and circumvertical mastopexies.

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undermining around the areola and ideally should be limited to the minimum required to redrape the skin. The risk of NAC malposition may be reduced by careful intraoperative tailor-tacking but is ultimately dependent on several unpredictable variables.

REFERENCES