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Safe Augmentation Mastopexy: Review of 500 Consecutive Cases Using a Vertical Approach and Muscular Sling

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Background: Augmentation mastopexy remains a challenging surgery and has been frequently associated with suboptimal outcomes and remarkable reoperation rates, and one of the greatest challenges in mastopexy surgery is areolar lift, especially when implants are simultaneously used. Through the authors' experience, this study is aimed to show a modification of the vertical approach with greater safety of the areolar pedicle.

Methods: The study included all patients who underwent augmentation mastopexy surgery performed by the authors between 2019 and 2022, whether primary or nonprimary, and performed a retrospective chart review of all patients who underwent this procedure.

Results: The length of the areolar lift ranged from 0 cm to 14 cm. Among the 17.4% of nonprimary mastopexies, the longest areolar lift was 11 cm. No cases of nipple–areola complex ischemia/necrosis were observed. With this technique, there were 6.2% complications (n = 31), none of which were considered serious.

Conclusions: This surgical sequence is a safe option for areolar lift in augmentation mastopexy. The vertical approach also has the advantage of producing considerably shorter horizontal scars. It is also reproducible, keeping the implant stable, which results in consistent long-term results. *(Plast Reconstr Surg Glob Open 2024; 11:e5504; doi: 10.1097/GOX.0000000000005504; Published online 8 January 2024.)*

INTRODUCTION

Augmentation mastopexy has frequently been associated with suboptimal outcomes and remarkable reoperation rates.[1–7] However, using standardized approaches, it is now accepted as a safe procedure.[2,8–14]

Over the last few decades, vertical mammoplasty has become the preferred approach by several American surgeons. Dartigues first described a vertical mammoplasty in 1925. Arie in 1957 and Claude Lassus (1969) adapted it. Following Lassus' concepts, Lejour introduced her vertical mammoplasty technique in 1990.[15–19]

In 1981, Benelli managed to diminish mammoplasty scars through a periareolar approach, using the round block tactic to decrease the risk of areolar enlargement and distortion. In Brazil, Mirian Pedron published a vertical approach for breast reduction and mastopexies without implants.[20–23]

After Hall-Findlay introduced her short-scar technique, especially after describing the use of superiorly and medially based areolar flaps, it became possible to achieve good and safe results even in severe breast ptosis cases.[24] The literature shows that the risk of NAC necrosis in breast reduction surgery is four times higher for a Wise-patern approach than for a vertical approach (1 of 100 versus 1 of 400 cases).[8,9]

In 2019, Ono and Karner published the article "Four-Step Augmentation Mastopexy: Lift and Augmentation

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at Single Time (LAST)," which describes a technique for augmentation mastopexy that provides inferolateral muscular support for implants and standardizes a sequence of surgical stages.[25] In this modification, we apply the basic step-by-step and muscular support concepts, but instead performed an extended vertical approach to handle breast tissue.

We observed that using this vertical approach, the inferior traction of the breast tissue was diminished and the dermal areolar pedicle was wider, making the NAC lift an easier and safer task. This feature is especially important in nonprimary cases, large-volume breast reduction, and long-length areolar lifts.

This article reviews the results obtained in 500 patients who underwent this four-step vertical approach, demonstrating the observed superior areolar safety compared with the original LAST technique.

METHODS

This study was performed in full conformity with the ethical norms and standards of the Declaration of Helsinki. The study included every patient who underwent augmentation mastopexy surgery performed by the authors between December 2019 and December 2022, whether primary or nonprimary. There were no other inclusion or exclusion criteria. We performed a retrospective chart review for all patients who underwent this procedure.

Takeaways

Question: Alternative surgical technique for stable long-term results in augmentation mastopexy.

Findings: The study describes the step-by-step sequence for short-scar augmentation mastopexy with muscular sling.

Meaning: New sequence eases areolar lift and shortens horizontal scars.

SURGICAL TECHNIQUE

Surgical Markings

With the patient in the standing position and arms along the torso, the surgeon marks the thoracic midline, the median axis of the breasts (from the clavicles), the projection of the new nipple-areola complex (NAC) position (point "A"), and the initial vertical tissue resection width.

The A point may be determined by two parameters: (a) raising up the breast to simulate the desired upper pole (corresponding to the axillary crease) and marking a point about 10cm below this line, and (b) placing two fingers on the breast, finding the projection of the inframammary fold (IMF) at the hemiclavicular line (breast median axis).[26] The A point will usually rest 16–18 cm from the sternal furcula. (Fig. 1 A, B).

Vertical tissue resection initial margins were marked from the point A to a caudal limit 1–2 cm cranial to the

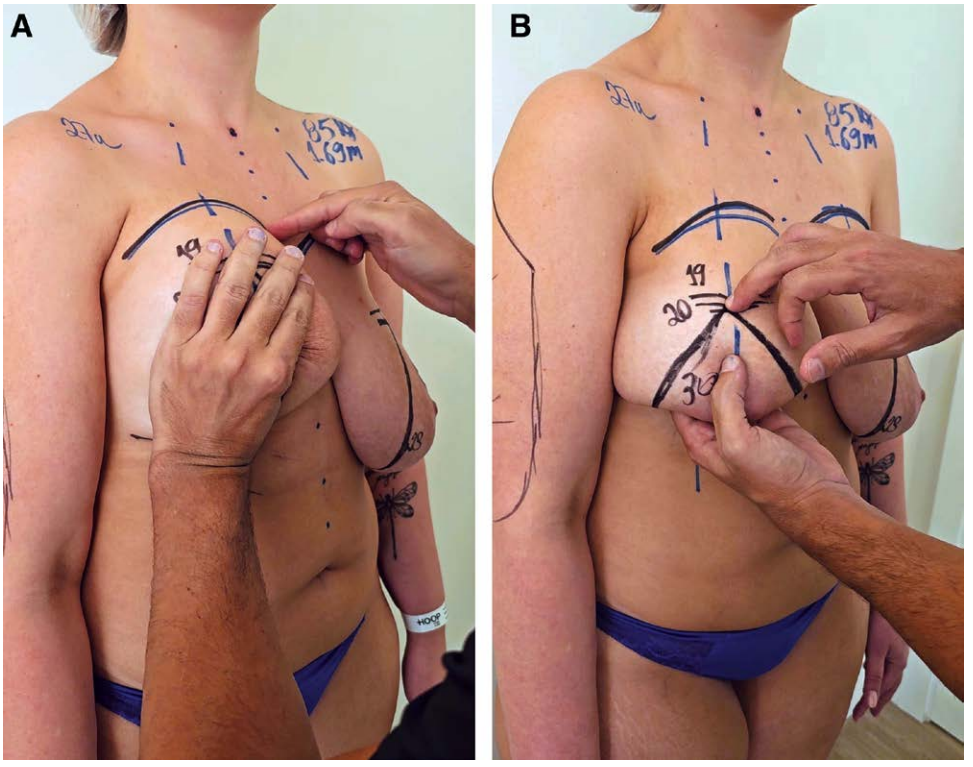

Fig. 1. Raising up the breast to simulate the desired upper pole. The "A" point will be marked about 10 cm below this line (A). A bidigital maneuver finding the projection of the IMF at the hemiclavicular line (B).

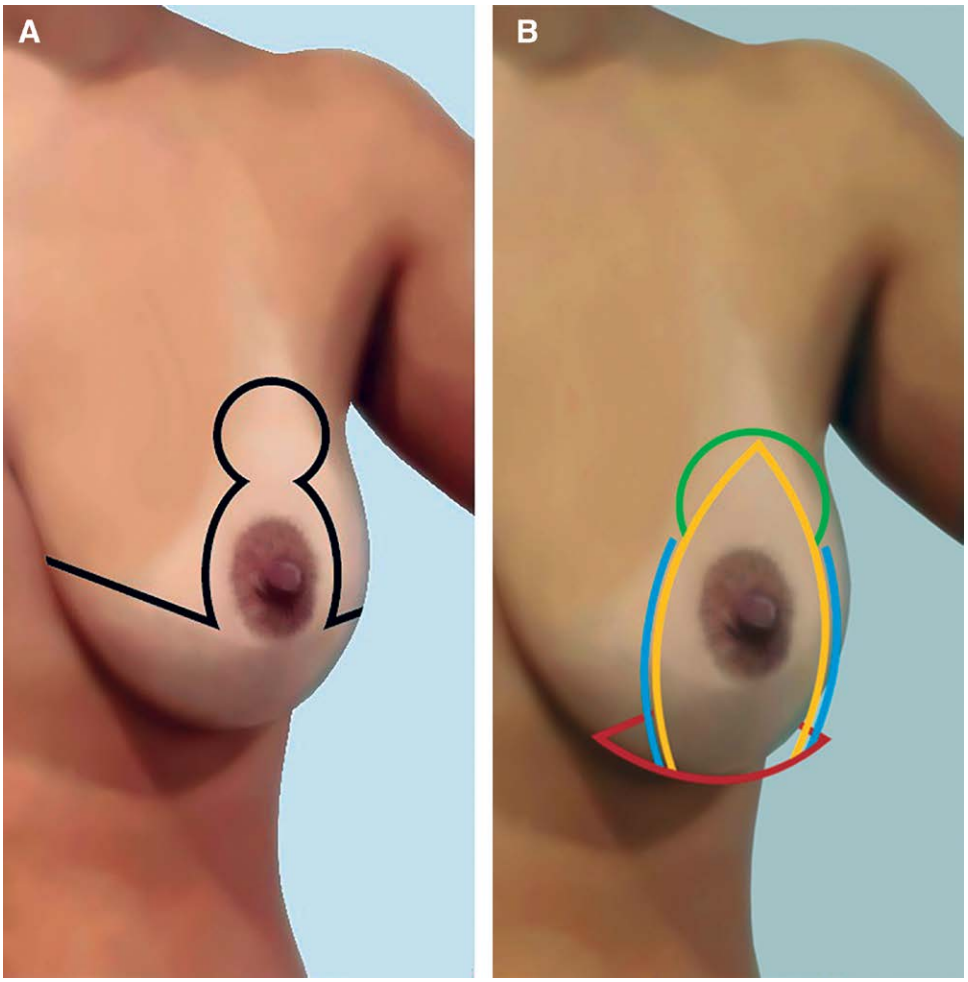

Fig. 2. Comparison between LAST and safe augmentation mastopexy markings. A, In black: original LAST markings. B, Extended vertical modification. Yellow: initial vertical resection margins. Blue: final vertical margins (customized). Red: horizontal resection margins. Green: periareolar de-epithelialization margins.

IMF, drawing the skin at the midline, whereas the breast was medially and laterally dislocated.

Finally, with the patient in a supine position and pushing the breast tissue caudally, the precise IMF position was delineated and marked. Interrupting the vertical skin incision markings 1–2 cm cranial to the original IMF is a fundamental step in allowing a shorter horizontal scar.

Compared with the original Wise-pattern LAST markings, the vertical extended approach results in much shorter horizontal scars and the need for shorter areolar lift (Fig. 2).

Surgical Steps

Step 1: Subpectoral Pocket and Augmentation

A skin incision was made at the projection of the sixth rib inferior border (IMF level) or approximately 1–2 cm cranial to it. The pectoralis costal origins were identified. The muscle fibers were transversely divided (3cm in length) at the level of the fifth intercostal space. A subpectoral pocket was created leaving the inferolateral and inferomedial pectoralis costal origins intact, resulting in a muscular "double-sling" (Fig. 3) (**See figure, Supplemental Digital Content 1,** which shows that interrupting the vertical skin incision markings 1–2 cm cranial to the original IMF is a fundamental step to allow a shorter horizontal scar. **http://links.lww.com/PRSGO/C971**.)

After implant insertion, the table was positioned at a 45-degree angle, and the upper pole symmetry was checked. In most cases, the implant lower pole lies tangential to the sixth rib or overlaps its upper portion, and palpation of the intercostal spaces is a reliable method for ensuring implant position symmetry.

The subpectoral pockets were then completely sealed by interrupted sutures biting the breast parenchyma cranially and inferolateral sling (lateral), rectus abdominis muscle aponeurosis (central), and inferomedial sling (medial) caudally.

The sutures do not restore full pectoralis coverage over the implant, as the central lower pole remains covered by the parenchyma layer only. The implants were fully covered and stabilized by the muscular double-sling.

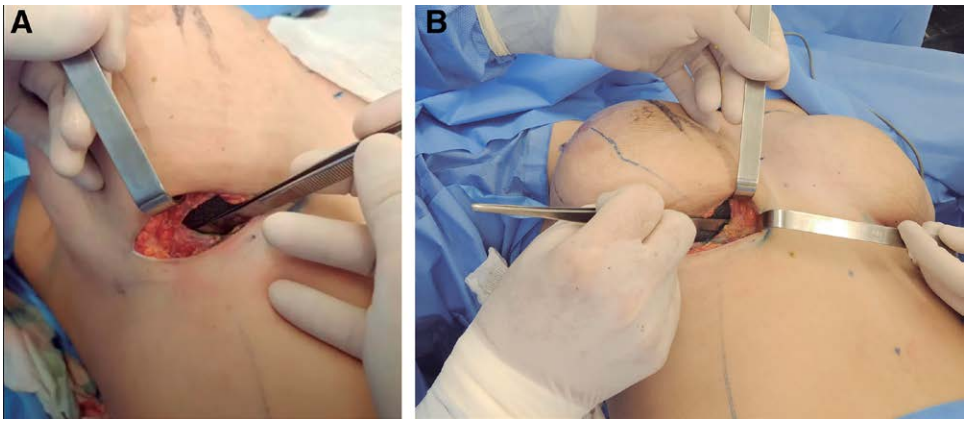

Fig. 3. The "double-sling." The subpectoral pocket sparing both the inferolateral (A) inferomedial (B) pectoralis costal origins, resulting in a muscular double-sling.

Fig. 4. Periareolar de-epithelialized skin.

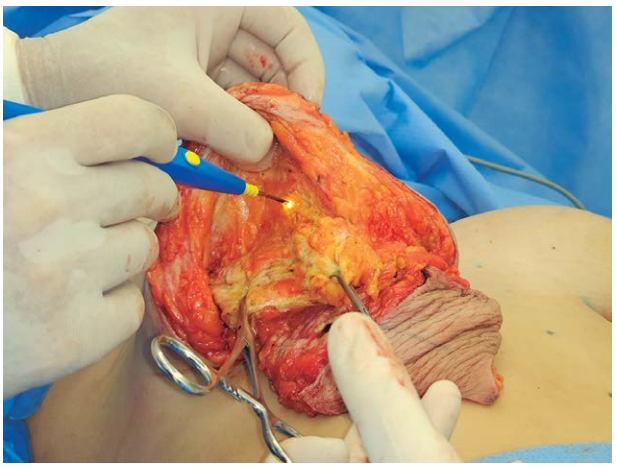

Fig. 5. Breast tissue resection.

Step 2: Tissue Resection

The first assistant stretched the skin while the surgeon marked the areola. The areolar marking diameter is 3.6 cm for small or medium breasts (lift up to 8 cm length), 4.0 cm for large breasts (lift up to 12 cm length) and 4.4 cm for lifts longer than 12 cm or for wide-base breasts. The periareolar skin was de-epithelialized (Fig. 4).

The next step was parenchymal resection. The surgeon constantly palpated the remnant tissue thickness, while the assistant performed counter traction by pulling the parenchyma to be removed. The goal is to obtain a uniformly thin (1.7–2.0 cm thickness) breast tissue coverage over the entire implant surface area (Fig. 5). [**See figure, Supplemental Digital Content 2,** which shows a uniformly thin (1.7–2.0 cm) thickness. **http://links.lww.com/PRSGO/C972**.]

Step 3: Areolar Lift

Lateral and medial incisions were performed approximately 1.5 cm away from the areolar margins to separate them from the vertical limbs and avoid caudal traction of the areola. The dermis was divided up to the areolar cranial margin, whereas a full-thickness division (dermis + parenchyma) was performed up to one-third of the areola height. When an excessive amount of parenchyma is present, these full-thickness incisions may become a triangular-shaped resection in one or both sides (Fig. 6). [**See Video 1 (online),** which shows the amplitude of the areolar flap.] The areola is lifted to its new position (point A).

Step 4: Vertical Management

The surgeon pulled the breast tissue vertical limbs over the implant and determined where they should rest to obtain the best breast shape. The setting must provide adequate breast projection, but also improve the lateral contour of the thorax, and the tension on the limb suture line should not be high. Once these features were obtained, three marks were made along the limbs to guide the sutures.

The most cranial mark should be made slightly caudal to the intended vertical apex, to spare enough space for a tension-free areolar flap inset. Interrupted Mononylon 2.0 sutures put together the vertical limbs (Fig. 7).

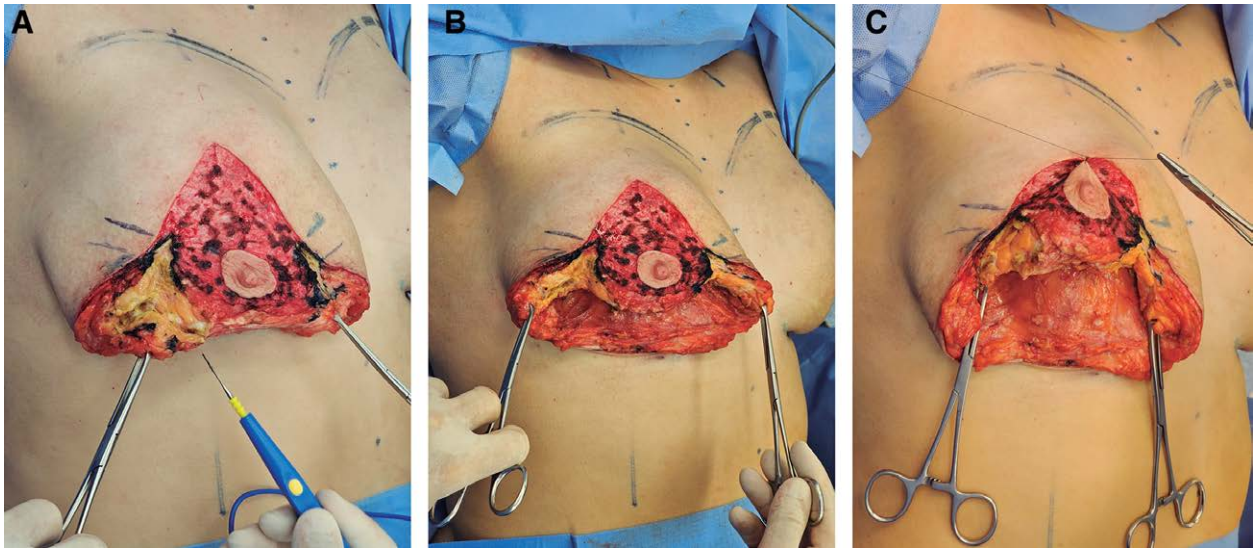

Fig. 6. Facilitating the lift of the areolar flap. Triangular-shaped resection to remove the excessive amount of parenchyma (A). Wide cranially-based areolar flap ready for lift (B). Areolar flap fixed at "A point" (C).

Fig. 7. Three marks to guide suture of the parenchyma limbs.

Using two forceps, the surgeon gently pinched and everted the skin borders in the midline to find the most suitable spot for the vertical apex. The selected spot was marked, and a deep subdermal 3.0 mononylon suture was placed (Fig. 8).

Following this subdermal suture, the surgeon applied light caudal traction to the breast and brought the limbs

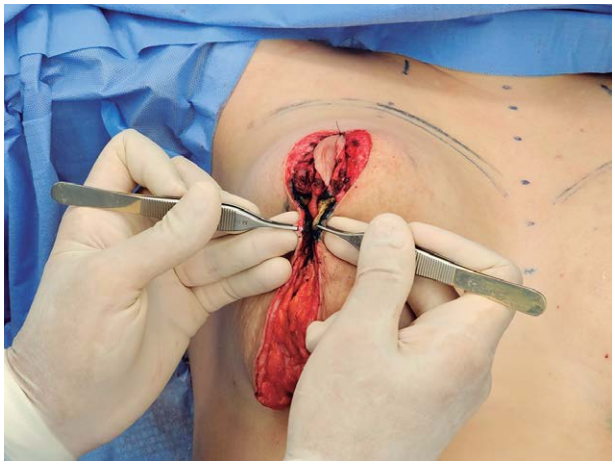

Fig. 8. Pinching the skin to determine the vertical apex.

closer together, judging whether additional vertical parenchyma or skin resection was necessary. If so, Allis forceps were used to apply gentle pressure to the skin and mark the additional vertical resection (Fig. 9). Multilayer sutures (3.0 and 4.0 mononylon) put together the vertical limbs.

Step 5: Horizontal Management

With the table positioned at a 30-degree angle and the breast slightly pulled caudally, the neo-IMF shows itself. A three-point suture attached the caudal vertical limbs to the chest wall (abdominis rectus aponeurosis) at the level of the IMF. This intersection may be adjusted medially or laterally as needed.

The resulting "dog ears" guide the horizontal markings and full-thickness resection. These customized markings grant a horizontal scar precisely placed at the IMF (Fig. 10). The final vertical length is usually approximately 6.0–7.2 cm (larger implants or breasts). Skin-parenchyma

Fig. 9. Light caudal traction and gentle pressure with Allis forceps to determine customized additional vertical resection.

Fig. 10. Light caudal traction and gentle pressure with Allis forceps to determine customized additional vertical resection.

dissociation and outward rotation of the medial limb may result in an L-shaped scar.

Step 6: Periareolar Management

The diameter of the periareolar skin to be de-epithelialized is usually 0.7–0.8 cm wider than the areola (the final diameter ranges from 5 cm to 6 cm). At this time, if necessary, it is still possible to make fine adjustments to the vertical length. The vertical length may be shortened, by marking the periareolar de-epithelialization area overlapping its cranial portion, or it may be elongated by placing an extracranial subdermal suture on the apex (described in step 4) and marking the periareolar de-epithelialization area cranial to it (Fig. 11).

However, this mark, like all others in the procedure, can be customized. This can be achieved by pushing the periareolar skin toward the center of the breast mound until a smooth, round breast contour is obtained.

Ideally, the final periareolar and vertical skin tension should be similar. This feature ensures the long-term

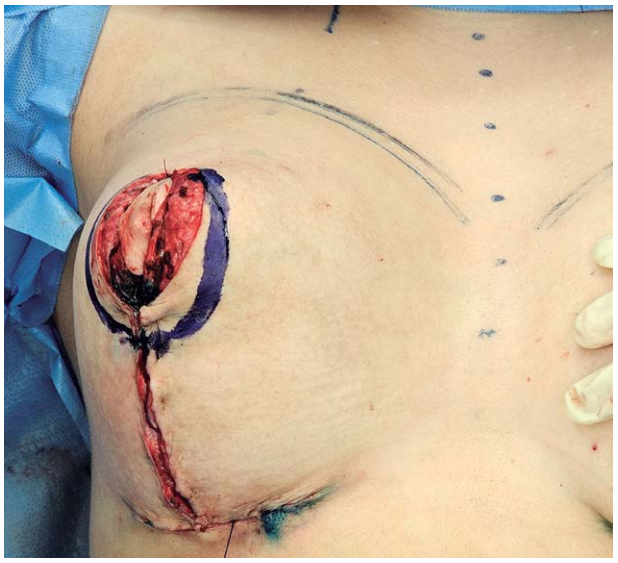

Fig. 11. Caudal traction of the breast shows the precise level of the desired IMF. Markings and full-thickness resection are performed.

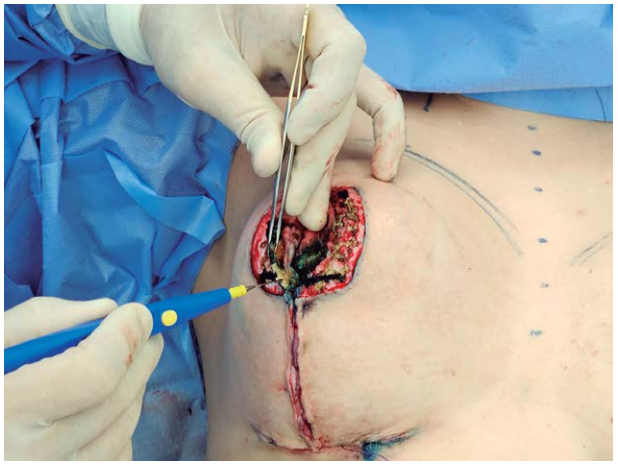

Fig. 12. The periareolar skin area to be de-epithelialized.

stability of the breast shape. [**See Video 2 (online),** which summarizes the procedure's main steps.]

On average, the final distance from the thoracic midline to the areolar medial border was 8–9.5 cm.

After the periareolar skin is de-epithelialized, minor final superior pedicle areolar flap release is accomplished through short parenchyma and dermal horizontal incisions, completely separating it from the vertical limbs and increasing latero-lateral mobility (Fig. 12). Extra–parenchymal resection from the lateral limb may be necessary to obtain a tension-free areolar flap inset.

Temporary cardinal and intercardinal mononylon 4.0 sutures lay out the areola. Nylon 3-0 (Mononylon) circular round-block purse-string sutures were placed and tightened until the resultant periareolar skin tension was similar to vertical skin tension. (Fig. 13). Minor periareolar skin contour adjustments may be performed to improve the shape and symmetry.

Fig. 13. Horizontal dermis/parenchyma incisions increase areolar flap mobility.

Monocryl 4-0 intradermal sutures were used to complete areolar, vertical, and horizontal wound closures. Permeable adhesive dressing tapes were applied over the suture lines for 3 weeks (changed every week), and soft compression bras were indicated for approximately 1 month. Patients were seen weekly for the first 3 weeks, after 6 weeks, and after 3, 6, and 12 months.

RESULTS

From June 2019 to December 2022, 500 female patients underwent surgery. The same surgical sequence was applied to every case of augmentation mastopexy, regardless of breast volume or degree of ptosis. The patients' ages ranged from 18 to 70 years (mean 38 years). The patients had previously undergone some type of mastopexy in 17.4% (n = 87) of cases. Augmentation mastopexies were associated with other aesthetic procedures (mainly liposuction and abdominoplasty) in 55.2% (n = 276) of the cases.

General anesthesia was performed in most cases (n = 203; 40.6%), general + spinal anesthesia in 34.2% of cases (n = 171), sedation + epidural anesthesia in 13.6% (n = 68), general + epidural anesthesia in 27 patients (5.4%), and high spinal anesthesia (above T4 level) in 23 cases (4.6%).

The mean implant volume was 275 mL. The implants used were Polytech (38.2%, n = 191), Motiva (25.8%, n = 129), Silimed (24.8%, n = 124), Mentor (11%, n = 55), and ISD (0.2% n = 1). The average parenchymal resection weight was 327.08 g. In 11.2% of cases, the resected tissue weight was over 600 g. The largest resection weighed 1302 g.

The length of the areolar lift ranged from 0 cm to 14 cm. Among the 17.4% of nonprimary mastopexies, the longest areolar lift was 11 cm. No cases of NAC ischemia/necrosis were observed. We observed 6.2% adverse events (n = 31), none of which were considered serious (**See figure, Supplemental Digital Content 3**, which shows the adverse events. **http://links.lww.com/PRSGO/C973**.)

Postoperative follow-up ranged from 6 to 42 months (average 18.2 months). All patients were photographed preoperatively and at several postoperative stages (6 weeks and 3, 6, and 12 months). [**See figure, Supplemental Digital Content 4**, which shows a 34-year-old patient. Augmentation mastopexy was performed with Motiva Silk Round Full 255-cc implants. Tissue resection weighed 530 g (right breast) and 530 g (left breast). The patient is shown preoperatively and at 15-month follow-up. **http://links.lww.com/PRSGO/C974**.] [**See figure, Supplemental Digital Content 5,** which shows a 40-year-old patient. Augmentation mastopexy was performed with Silimed Biodesign True Texture Maximum High 270-cc implants. Tissue resection weighed 42 g (right breast) and 55 g (left breast). The patient is shown preoperatively and at 10-month follow-up. **http://links.lww.com/PRSGO/C975**.] [**See figure, Supplemental Digital Content 6**, which shows a 42-year-old patient. Augmentation mastopexy was performed with Silimed Biodesign True Texture Maximum High 285-cc implants. Tissue resection weighed 166 g (right breast) and 212 g (left breast). The patient is shown preoperatively and at 10-month follow-up. Abdominoplasty was also performed at the same time. **http://links.lww.com/PRSGO/C976**.]

DISCUSSION

One of the greatest challenges in mastopexy surgery is the areolar lift, especially when implants are used simultaneously.[4,6,26] NAC necrosis is a dramatic event that causes irreversible sequelae and is a common cause of litigation.[4–6,27,28]

In breast reduction surgery, the most frequent areolar flap pedicles are inferior-based and Wise-pattern.[27] Davidson demonstrated the versatility of a superomedial-based areolar pedicle.[29]

In this approach, a superior pedicle areolar flap with a wide dermal area is used. It ensures a robust random vascular supply to the areolas and allows the medial and lateral vertical parenchyma limbs to be firmly sutured together, thereby narrowing the breast width and enhancing its projection.

The association of this firm suture to vertical tissue resection provides upper pole fullness and projection. The final thickness of the areolar flap is approximately 1.7 to 2.0 cm, which is compatible with Lassus' concepts.[8,18,30] This approach allowed the authors to standardize the areolar lift, resulting in 0% NAC ischemia in all 500 patients (1000 areolas), including 14.4% of nonprimary mastopexy operations.

Roux stated that preserving a wide dermal base and avoiding rotation of the areolar flap base contributes to reducing the risk of venous congestion.[18] The wide periareolar de-epithelialized area provides a broad vascular base. This feature is especially important in nonprimary mastopexy, when the previous areolar lift approach and, therefore, the axial vascular supply (if present) is unknown.

Despite Calobrace et al asserting that the autonomization effect occurs after 6–12 months,[31] we observe a considerable rate of areolar ischemic complications in

nonprimary mastopexy when a combination of aggressive lift, rotation, and retroareolar debulking is performed.

Elevating the NAC at the beginning of the procedure and marking the vertical limb length only after the NAC has been lifted prevents it from being pulled caudally. Therefore, compared with the previous technique,[25] the required lift length is shorter. This new approach granted consistent and safe areolar lifts, showing much lower complication rates than those described in the original technique (LAST),[25] even for nonprimary mastopexies.

Skin resection is predominantly vertical and periareolar, requiring less horizontal resection and resulting in shorter horizontal scars.[24] Patient feedback about this feature is positive, as the vast majority of horizontal scars do not reach cleavage and are easily covered by bikinis and bras. Horizontal scars are always placed exactly at the inframammary fold because horizontal skin resection is marked after the breast has already been shaped.

Because the augmentation part of the surgery is performed through an inframammary approach and the implants are entirely isolated in the retropectoral pocket before mastopexy parenchyma manipulation occurs, the "14-point plan" can be followed.[31]

The absence of fixed skin markings and tissue resection guided by the pinch test prevents overresection or excessive suture tension. Thin and uniform parenchymal coverage prevents the waterfall effect and eases areolar lift and accommodation.

The final diameter of the areolas range from 3.6 to 4.4 cm, and round-block sutures must always be performed to prevent poor scars and areolar enlargement.[20,21] If one tries to push for a smaller areolar diameter, the round-block suture may have to be too tight and produce excessive tension, breast flattening, and wrinkled circumareolar skin.

Obtaining an appropriate balance between the extent of vertical and periareolar skin resections is a subjective task. This balance is mainly determined at the beginning of the fourth step (bimanual pinch) and the sixth step (determining the diameter of the periareolar skin to be de-epithelialized). The goal is to excise enough tissue to prevent lower pole redundancy/stretching, but at the same time, to not cause excessive tension that may lead to dehiscence or unpleasant scars. Unfortunately, these measures are not standardized but are tailored case by case.

The Wise-pattern technique publication related to epidermolysis of the NAC (of 266 patients), whereas no case was reported after the modification (of 500 patients). We believe that vertical resection promotes a better elevation of the NAC due to the direction of the vectors for closure and does not pull the breasts downwards, which occurs in the original technique.

Point A was, on average, 2 cm lower with the marking modification (vertical) than with the original technique. The base of the pedicle is much wider in the vertical technique (between 200 and 270 degrees) than in the base technique (between 40 and 50 degrees), which makes the pedicle of the vertical technique less dependent on the axial blood supply.

For all these factors, the vertical technique is safer from the point of view of vascularization of the areolas, especially for nonprimary cases, dense and reducing breasts, and cases with greater areolar elevations. We also observed better lateral chest contouring owing to vertical traction, and a smaller horizontal scar.

CONCLUSIONS

This surgical sequence is a safe option for areolar lift in augmentation mastopexy. Considering that there were no cases of NAC vascular complications, in our experience, it proved to be safer than the four-step original description.[24]

The vertical approach also has the advantage of considerably shorter horizontal scars, which is an appealing feature for the patient. The technique is reproducible, as many plastic surgeons who visited us to learn it are currently performing the surgery and achieving results that are very similar to ours.

In comparison with the original LAST description, this vertical sequence improved the areolar lift, shortened the horizontal scars, and expanded the safe indication of augmentation mastopexy, even for dense and heavy breasts. Because of these features, this group of authors (including the authors of the original LAST article) considered this approach as an evolution of the four-step sequence.[24]

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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