



# An Oncoplastic Surgery Primer: Common Indications, Techniques, and Complications in Level 1 and 2 Volume Displacement Oncoplastic Surgery

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**ABSTRACT** Oncoplastic surgery is a form of breast-conservation surgery that involves volume displacement and replacement techniques for optimal aesthetic results after oncologic resection with partial mastectomy. With growing emphasis on breast conservation, oncoplastic surgery is becoming a critical component in the approach to breast cancer in appropriately selected patients. Thus, it is paramount that surgeons are informed about oncoplastic surgery and its use in breast cancer treatment. This primer aims to provide key information regarding oncoplastic surgery. To accomplish this, we used supportive evidence from the literature, combined with clinical experience. The primer uses the American Society of Breast Surgeon's consensus definition and classification system for oncoplastic surgery, focusing on level 1 and 2 volume displacement techniques. We outline procedures within these categories, review common indications, and provide a guide to approaching tumors based on their quadrant position. The paper also describes complications specific to these procedures, as well as their management. Understanding these concepts will allow surgeons to assist patients in making informed decisions using these breast-conservation techniques.

In 2018, breast cancer was the second most common form of cancer among women, with an incidence of 25.4%.<sup>1</sup> Due to advances in therapies, improved screening

modalities, and increased life expectancy, there has been an improvement in overall survival in patients assigned a diagnosis of breast cancer.<sup>2,3</sup> With increasing cancer survivorship, surgical management has also evolved, with a focus on decreasing surgical morbidity and improving quality-of-life outcomes. We have seen these paradigm shifts evolve over the years, from Halsted's radical mastectomy to our emphasis on breast conservation.<sup>4</sup> With this trend towards breast conservation, there has been increased interest in oncoplastic surgical techniques.<sup>5</sup>

Oncoplastic surgery is performed to combine oncologic resection, via partial mastectomy, with aesthetic results using volume displacement or replacement designs.<sup>6</sup> Evidence suggests that oncoplastic breast conservation is more likely to achieve negative margins and has demonstrated decreased rates of re-excision.<sup>7,8</sup> Validated patient-reported outcomes data have shown improved clinical benefits in psychosocial and aesthetic outcomes when compared with mastectomy with immediate reconstruction,<sup>9</sup> and clinical utility analyses have proven the cost effectiveness of the oncoplastic surgical approach.<sup>10–12</sup> Given this, it is paramount that surgeons continue to train in oncoplastic surgery so that patients are informed and have access to oncoplastic surgery when appropriate. This primer focuses on the definitions, indications, procedures, and complications associated specifically with basic and intermediate skill levels in oncoplastic surgery in an effort to promote breast conservation.

## DEFINITION

Oncoplastic surgery was first defined by Audretsch et al.<sup>13</sup> and encompassed plastic and reconstructive surgical approaches to resection of tumors with satisfactory margins in conservative treatment in order to minimize deformities.

Various techniques have been described, such as cosmetic quadrantectomy by Silverstein,<sup>14</sup> lower pole tumor reduction mammoplasty by Clough et al.,<sup>15</sup> and central tumor reduction by Grisotti.<sup>16</sup> Over time, oncoplastic surgery has evolved to encompass a wide range of procedures that involve simultaneous application of partial mastectomy and reconstructive techniques in patients undergoing breast-conserving surgery. The American Society of Breast Surgeons (ASBrS) developed a consensus definition of oncoplastic surgery as a form of breast-conservation surgery that includes oncologic resection with a partial mastectomy, ipsilateral reconstruction using volume displacement, or volume replacement techniques with possible contralateral symmetry surgery when appropriate.<sup>6</sup> The ASBrS also developed a consensus classification system, as shown in Table 1.

## INDICATIONS AND CONTRAINDICATIONS

Patients who are eligible for breast conservation, with appropriate breast size and ptosis relative to cancer burden, should be considered appropriate candidates for oncoplastic surgery. This procedure is particularly beneficial for those who will likely develop a breast deformity following a standard partial mastectomy. Up to 30% of women undergoing breast-conservation surgery will develop a deformity that may require revision surgery. This is most commonly observed when more than 20% of breast volume is resected, as well as with tumors in the medial, superior, or retroareolar regions.<sup>17–19</sup> Given this, patients with moderate- to large-sized breasts or at least grade 2 ptosis largely benefit from oncoplastic surgery.<sup>20</sup> A level 2 volume displacement oncoplastic technique using reduction mammoplasty designs can remove cancer as well as treat symptomatic macromastia, all while creating an aesthetically appealing breast form.<sup>21</sup> Additionally, breast reduction oncoplastic designs inherently reduce overall breast volume and skin envelope, thus facilitating adjuvant

radiation planning. There are few contraindications to oncoplastic surgery. In general, these are similar to the contraindications associated with breast conservation, including a history of breast radiation, other contraindications to adjuvant radiation, inflammatory breast cancer, and large tumor-to-breast volume ratio.

## PROCEDURE TYPES

### *Level 1 Volume Displacement Oncoplastic Surgery*

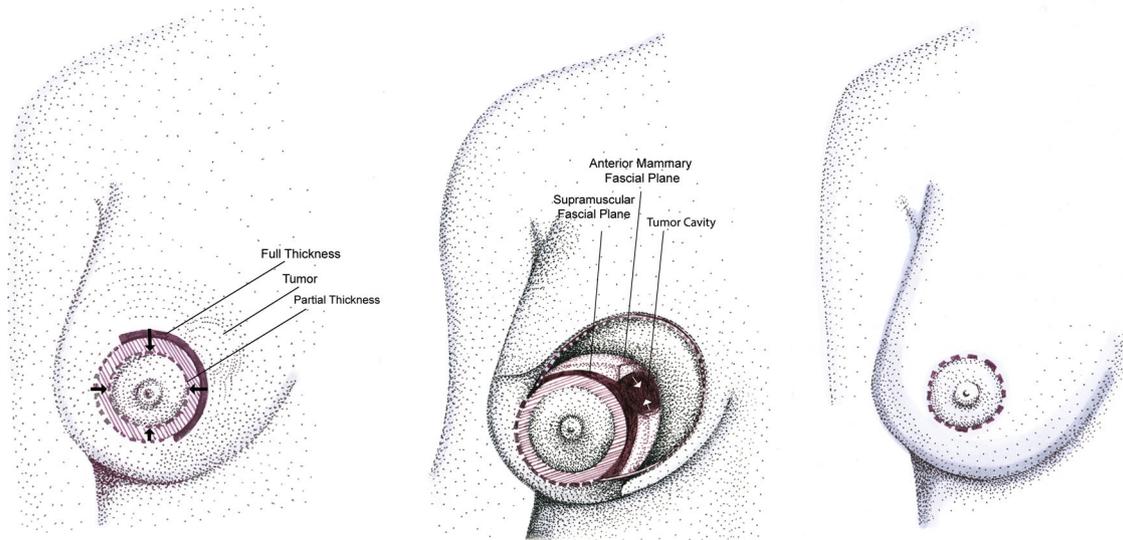
Level 1 volume displacement oncoplastic surgery can be considered when < 20% of breast tissue is excised during partial mastectomy in small- to moderate-sized breasts with minimal ptosis.<sup>6,20,22,23</sup> In general, surgeons should not perform this type of operation in breasts that are predominant with fat because approximating sutures can shred the tissue.<sup>24</sup> There are several types of level 1 techniques, all of which include some form of local tissue rearrangement to obliterate the resection cavity.

At its core, level 1 volume displacement oncoplastic surgery is dependent on aesthetically placed incisions, specifically at the inframammary crease, the periareolar margin, or the anterior axillary line. Once this is done, a partial mastectomy is performed and the space subsequently filled in with advanced dermoglandular planes of tissue. Specifically, the surgeon creates dermoglandular planes using superficial dissection in a plane where the subcutaneous tissue and breast parenchyma intersect (anterior mammary fascial plane), and deep dissection in a plane where the breast parenchyma and muscular fascia intersect.

These principles are highlighted in specific types of level 1 volume displacement oncoplastic techniques such as the doughnut mastopexy (Fig. 1), which allows for access to any quadrant of the breast while limiting the incision scar to the periareolar area only. It is important to note that when designing a concentric mastopexy, the

**TABLE 1** Oncoplastic surgery classification<sup>6</sup>

	Examples
<i>Volume displacement</i>	
Level 1: < 20% of breast tissue removed	Local tissue rearrangement Crescent mastopexy Doughnut mastopexy
Level 2: 20–50% of breast tissue removed	Circumvertical mastopexy design Reduction mammoplasty designs (including free nipple graft)
<i>Volume replacement</i>	
> 50% of breast tissue removed	Implant-based reconstruction Local/regional flap reconstruction: thoracodorsal artery perforator



**FIG. 1** Doughnut mastopexy design incisions (left), glandular displacement (middle), and closure (right)

distance between the inner and outer circle incisions should typically be no more than 2 cm, but the outer circle may be placed in an asymmetric, more cephalad position to better elevate the nipple–areolar complex (NAC).<sup>25</sup> The skin spanning the two partial thickness incisions is de-epithelialized. A full-thickness incision is then made a few millimeters within the outer circle, no more than 50% of the outer circle circumference, so as to decrease the chances of nipple necrosis. Skin flaps in the anterior mammary fascial plane are then raised to gain access to the quadrant of interest. Care should be taken to minimize undermining the NAC to preserve its posterior glandular blood supply. The tumor is resected widely down to the pectoralis fascia, and the gland is reconstructed using a combination of undermining, advancement, and layered closure using absorbable sutures. The skin is closed using absorbable deep dermal sutures, followed by a permanent purse string running subcuticular suture to create a new areolar margin. Without the use of a permanent suture, the NAC can stretch out over time.<sup>26–30</sup>

The crescent mastopexy (Fig. 2) also allows for access to the upper inner and outer quadrants. It is important to note that when designing the outer crescentic semi-circle, the distance between the inner and outer semi-circle incisions should typically be no more than 2 cm. A full-thickness incision is made a few millimeters inside the outer semi-circle to gain access to the tumor. Once the tumor is removed and glandular displacement techniques are used to fill in the partial mastectomy void, the incisions are brought together with absorbable deep dermal and subcuticular skin sutures.

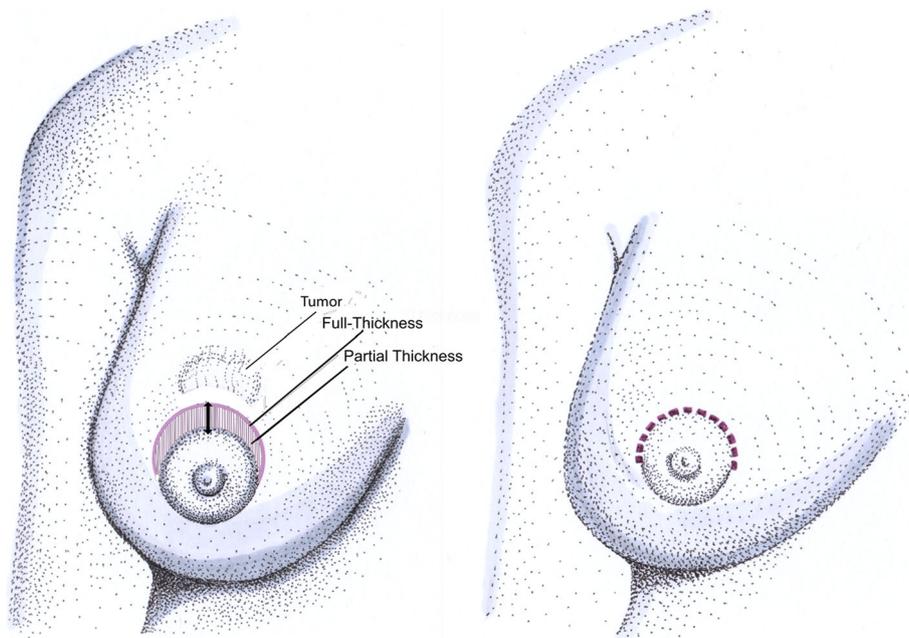
### *Level 2 Volume Displacement Oncoplastic Surgery*

Level 2 volume displacement oncoplastic surgery is performed when 20–50% of breast tissue is excised during the partial mastectomy in moderate- to large-sized breasts with moderate to severe ptosis.<sup>6,20,22,23,31</sup> These operations can be performed in breasts predominant with either fat or glandular tissue because dermoglandular pedicles can hold suture tension when manipulating tissue.<sup>24</sup> There are several types of level 2 techniques, each of which includes both a form of pedicle development (e.g. superomedial or inferior pedicle) and skin incision type (e.g. circumvertical or wise skin incision pattern).

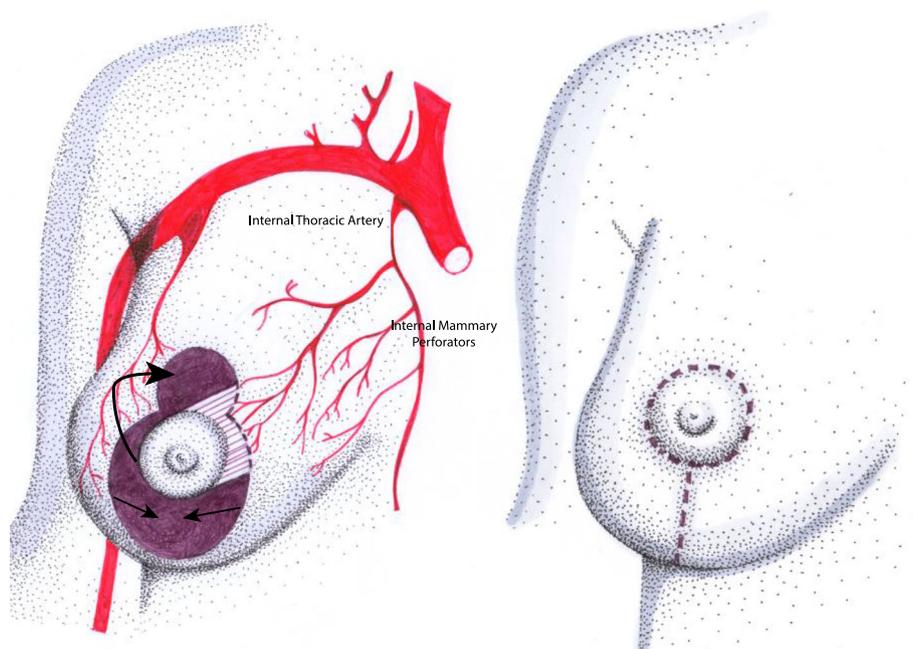
#### *Superomedial Pedicle, Circumvertical Skin Incision Design*

This technique (Fig. 3) is indicated in medium- to large-sized breasts with moderate to severe ptosis and is indicated for excision of tumors in the lower pole of the breast. In this example of a 6 o'clock cancer, first the superomedial pedicle is declared with a split-thickness incision, followed by incision down to the pectoralis fascia and elevation of the pedicle up to the media pillar border. Second, the rest of the circumvertical skin incision is made. The lower pole tumor is resected down to the pectoralis fascia, and the glandular tissue medial and lateral pillars are re-approximated, while the NAC attached to the superomedial pedicle is rotated into the superior keyhole. The incisions are closed with deep dermal absorbable sutures, followed by a subcuticular absorbable suture. Notably, the vertical incision is closed with an absorbable barbed suture starting from the base of the NAC to the

**FIG. 2** Crescent mastopexy design and closure



**FIG. 3** Superomedial pedicle, circumvertical skin incision design and closure



inframammary fold (IMF), while sequentially recruiting skin to prevent a dog ear of the inferior pole.<sup>26,27</sup>

#### *Superomedial Pedicle Wise-Pattern Skin Incision Design*

With large or ptotic breasts (grade 2 or 3 ptosis), a reduction mammoplasty may be beneficial with a wise skin incision (also known as inverted T) mammoplasty. The choice of a circumvertical versus wise skin pattern incision

typically depends on the severity of ptosis in that patients with severe ptosis are better served using a wise-pattern incision since it resects more skin. The superomedial pedicle wise-pattern skin incision technique not only allows for generous oncologic exposure and resection but also improves quality of life in patients with symptomatic macromastia.<sup>9,32</sup> As in the above superomedial pedicle, circumvertical skin incision example, blood supply to the NAC is maintained on a de-epithelialized dermoglandular superomedial pedicle. The wise skin incision pattern gives

vast exposure to the upper outer, lower outer, and inferior pole regions of the breast for cancer removal. Once the tumor is removed, the NAC is rotated into the superior keyhole and the medial and lateral pillars are approximated/co-apted at the T junction.<sup>25,26</sup>

#### *Inferior Pedicle/Central Mound Wise-Pattern Skin Incision Design*

This technique (shown in Fig. 5) is ideally performed for tumors located in the upper outer and upper inner quadrants of the breast. It can also be used in the lower inner and lower outer quadrants as long as the tumor does not overlap the 5–7 o'clock regions of the breast where the intercostal blood supply perfuses the inferior pedicle. The NAC lives on a de-epithelialized dermoglandular inferior pedicle. The inferior pedicle is de-epithelialized and advanced upwards (as needed) and into the glandular defect. Of note, if the inferior pedicle is left connected to the chest wall, thereby preserving the dual blood supply from the deep chest wall and inferior pedicle intercostal perforators, this would be known as a central mound pedicle technique. Resection of glandular tissue from the inner and outer lower breast quadrants is performed to create medial and lateral pillars that are advanced to the IMF incision, allowing for the inverted T-incision closure.<sup>27–29</sup>

#### *Inferior Pedicle Wise-Pattern with Free Nipple Graft*

When the NAC's blood supply is unable to be preserved due to centrally located tumor or significant ptosis, the NAC may be excised and repositioned as a full-thickness free nipple graft (shown in Fig. 6) in the desired location. After excision, the NAC is defatted and fenestrated (with a 15 blade) to promote graft take and prevent seroma formation. The wise skin incision pattern reduction mammoplasty is performed with removal of both the medial and lateral wings and the central region of the breast, including the subareolar tissue (and the centrally located tumor). The free nipple graft is transferred to a de-epithelialized bed of the superior keyhole, and sutured in place with absorbable suture. The authors' preference is to bolster the graft with a negative pressure wound vacuum dressing. This helps to promote a successful graft while decreasing the incidence of infection, seroma, and desiccation. This typically remains in place for 5–7 days.<sup>20</sup>

## MANAGEMENT BY QUADRANT

*Lower Pole (5–7 O'Clock Tumor Position)* A superomedial pedicle circumvertical (Fig. 3) or wise-pattern mammoplasty technique allows for large volume excision

and breast reshaping.<sup>22</sup> This technique can prevent a bird's beak deformity, which forms as a result of excision of tissue from this area due to skin retraction and downward deviation of the NAC, especially following adjuvant radiation therapy.

*Lower Inner Quadrant* For smaller tumors, a doughnut mastopexy design (Fig. 1) can provide excellent access to this region, especially if the breast is more glandular than fat. In larger breasts with a moderate-sized cancer, this can be managed using an inferior pedicle wise-pattern mammoplasty technique (Fig. 5). The medial wing wedge resection can often be placed so that the tumor is removed with the skin (as an anterior margin) down to the pectoralis fascia if needed.<sup>31</sup> Of note, if the inferior pedicle is left connected to the chest wall, thereby preserving the dual blood supply from the deep chest wall and inferior pedicle intercostal perforators, this would be known as a central mound pedicle wise-pattern mammoplasty technique. One may not need to undermine the pedicle, especially if superior advancement of the nipple is minimally needed.

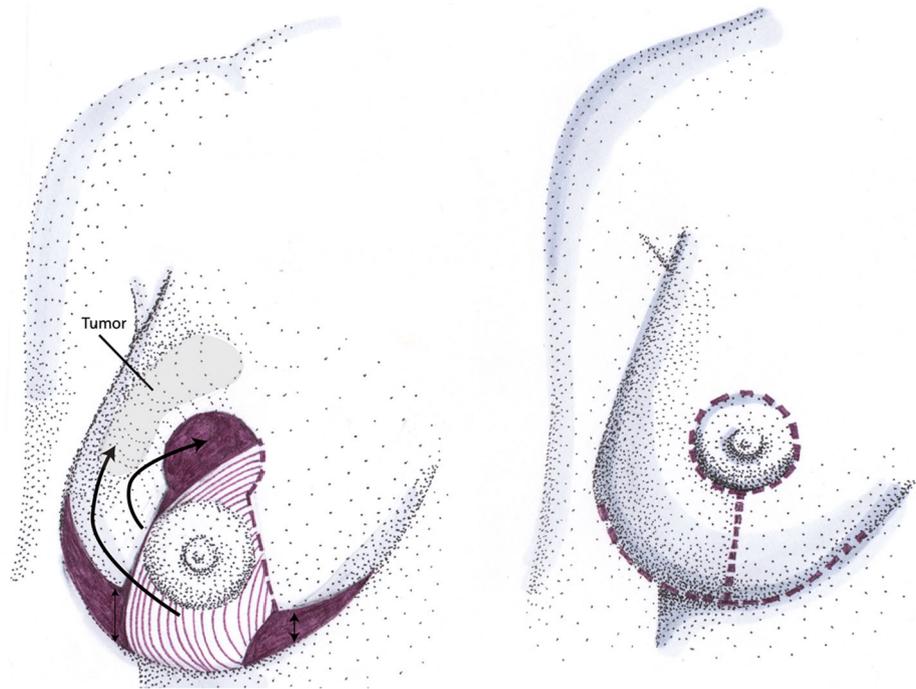
*Upper Inner Quadrant* For smaller tumors, a doughnut or crescent mastopexy design (Figs. 1, 2) can provide excellent access to this region, especially if the breast is more glandular than fat. This area is particularly troublesome to treat due to the significant impact on breast shape and cleavage with resections > 20%.<sup>22</sup> For larger excisions, using the advancement of the inferior pedicle wise-pattern technique can auto-augment the loss of tissue in the upper inner quadrant by way of the pedicle moving upwards and the skin envelope wrapping over.<sup>31</sup>

*Upper Pole* For smaller-volume excisions < 20% at the 12 o'clock position, either a doughnut or crescent mastopexy (Figs. 1, 2) could be used to correct most deformities. For larger excisions, an inferior pedicle wise-pattern reduction mammoplasty (Fig. 5) can be employed.

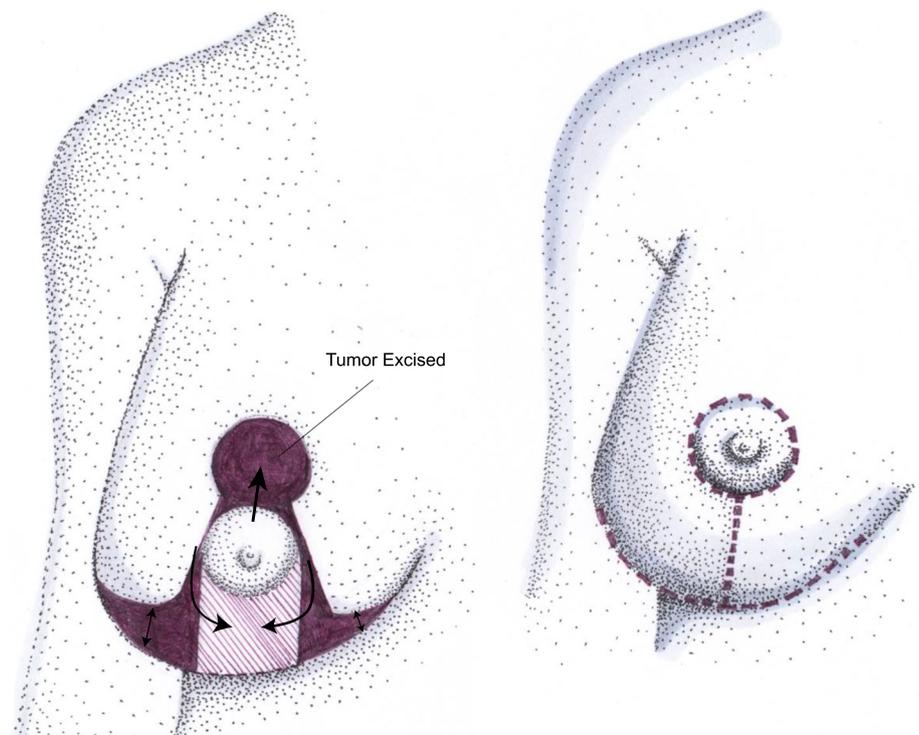
*Upper Outer Quadrant:* For smaller tumors, a doughnut or crescent mastopexy design (Figs. 1, 2) can provide excellent access to this region, especially if the breast is more glandular than fat. Large-volume excisions > 20% result in skin retraction and deviation of the NAC toward the involved quadrant. An extended superomedial (Fig. 4) or inferior pedicle (Fig. 5) wise-pattern design can be used. The extended superomedial pedicle allows for auto-augmentation of the upper-outer quadrant defect.

*Lower Outer Quadrant* For smaller tumors, a doughnut mastopexy design (Fig. 1) can provide excellent access to this region, especially if the breast is more glandular than fat. Large-volume resections can be performed using either a superomedial pedicle or inferior pedicle wise-pattern incision (Fig. 5). Such designs prevent lateral retraction of the breast and NAC.<sup>31</sup>

**FIG. 4** Extended superomedial pedicle wise-pattern skin incision design and closure



**FIG. 5** Inferior pedicle wise-pattern skin incision design and closure

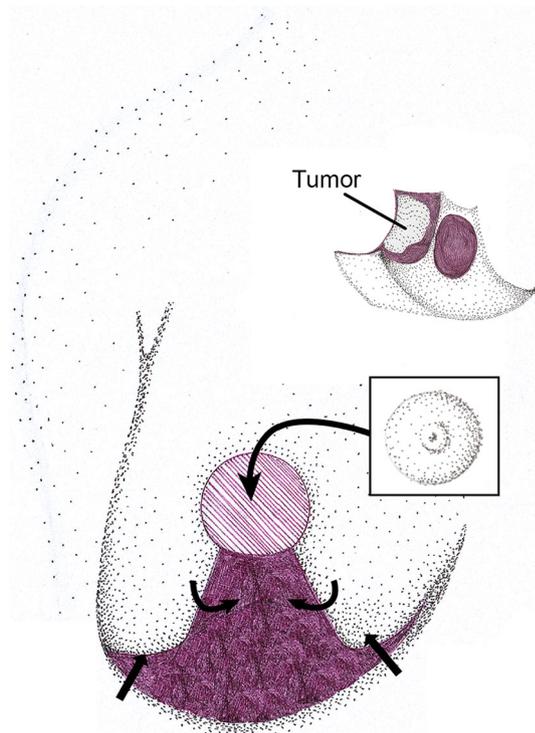


*Central Subareolar* Superficial subareolar tumors can be associated with NAC involvement, occasionally requiring removal of the NAC with the tumor. Oncoplastic reconstruction for this could involve a free nipple graft design with a wise-pattern skin incision (Fig. 6).

#### **COMMON COMPLICATIONS AND THEIR MANAGEMENT**

##### *Positive Margins*

Breast-conservation surgery necessitates complete resection, with adequate surgical margins, for oncologic



**FIG. 6** Free nipple graft with wise skin incision pattern

success. Oncoplastic techniques allow for more extensive volume resections and have lower rates of positive margins (6–12%)<sup>7,8,20,33,34</sup> compared with BCS (18–40%).<sup>35,36</sup>

Reoperation should be performed in patients who have inadequate margins, to decrease local recurrence. Risk factors for positive margins include higher-grade tumors, invasive lobular carcinoma, larger tumor size, and tumor stage.<sup>33</sup>

Following an inadequate margin, re-excision may still be possible if minimal disease is seen at one margin.<sup>33</sup> Multiple margins involved after a large oncoplastic resection often means that the breast has too much tumor burden for breast conservation. Re-excision should be performed in approximately 2–3 weeks, which allows enough time for perfusion to the nipple, while not losing the ability to deconstruct the breast and identify the region of positive margins. It is essential to have clear communication, regarding the geography of the breast, between the pathologist, breast surgeon, and plastic surgeon during surgery<sup>37</sup> so that when a positive margin does occur, all treating parties know exactly where that positive margin is located in the breast.

#### Wound Dehiscence

The inverted T junction in the wise incision pattern is the most frequent area for a wound-healing complication. The T junction is under the most tension and is therefore

the most ischemic portion of the suture line. For superficial dehiscence, we suggest treatment with antibiotic ointment and serial dressing changes. The vast majority of these wounds heal over 2 weeks. Rarely, if it persists, it can be superficially debrided and a split-thickness skin graft can be applied in a procedure room at approximately 3 weeks postoperatively to allow healing so there is no delay to adjuvant treatment.

#### Fat Necrosis

Fat necrosis can be troubling to patients in the early and late postoperative period as it can mimic local recurrence and can impact quality of life due to pain and poor cosmetic outcome. For most patients, surveillance is sufficient as fat necrosis sometimes resolves over several months. Some patients may need a core biopsy of this region to formally identify fat necrosis. If the patient has pain symptoms with fat necrosis, excision may be necessary.<sup>38</sup>

#### Breast Asymmetry

In our experience, breast asymmetry has not been a significant issue as it is our practice to perform a contralateral symmetry procedure during the index operation.<sup>20</sup> It is beneficial to leave the cancer side breast slightly larger (by approximately 10%) due to the expected adverse effect of radiation-induced glandular atrophy. If the desired cosmetic outcome is not achieved after completion of adjuvant therapy, then it may be necessary to perform additional symmetry surgery.

#### CONCLUSION

Oncoplastic surgery is an effective breast-conservation option for patients with breast cancer. When it is appropriately applied, it offers an oncologic safe resection with optimal cosmetic outcome. Given increasing awareness of its benefits, it is important that surgeons have knowledge about its indications and complications so that they can appropriately inform their patients.

**DISCLOSURE** Krishnabhai Patel, Joshua Bloom, Salvatore Nardello, Stephanie Cohen, Juliann Reiland, and Abhishek Chatterjee have no disclosures to declare.

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