

Evaluating the Blood Supply to the Nipple Areola Complex in Oncoplastic Surgery Planning: A Case Report and Step by Step Method

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Abstract

Background: The oncoplastic management of lumpectomy defects presents technical challenges. Oncologic principles and aesthetic outcomes are now more aligned. The senior authors (BPD) previously published their methods of using contrast-enhanced breast MRI to evaluate blood supply to the nipple areola complex [NAC] in secondary mastopexy augmentation. As breast conservation advances, repeat lumpectomy (second chance operations) with oncoplastic reconstruction is becoming more common. Direct knowledge of the blood supply to the NAC in the reoperated breast will be paramount to prevent complications and optimize aesthetic outcomes in these second chance operations. **Purpose:** We describe a step by step, MRI guided approach to planning for oncoplastic surgery, and demonstrate how to perform preoperative localization markings for complex oncoplastic reconstructions. The intended audience for this educational reference are the early career Oncologic Breast Surgeon and Plastic & Reconstructive surgeon. **Methods:** A case report details the management of a patient who underwent successful split Wise-pattern oncoplastic reconstruction of a lumpectomy defect and contralateral mastopexy for symmetry. Preoperative imaging and physical exam findings are used to map NAC vascularity and guide preoperative markings. **Results:** A straightforward, reproducible 5-step lumpectomy marking system is described. The technique optimizes oncologic resection, anterior margin clearance, and ease of dissection for the oncologic surgeon while preserving axial pattern skin-flap viability and thickness for the plastic surgeon to maximize the aesthetic result.

Maintaining well vascularized skin flaps minimizes long term sequelae of post lumpectomy radiation and facilitates potential secondary adjunctive mammary prosthesis or autologous reconstruction. **Conclusions:** Successful oncoplastic reconstruction requires a precise understanding of the blood supply to the NAC. Managing NAC blood supply becomes increasingly complicated if patients undergo sequential oncoplastic lumpectomy surgeries. Oncologic Breast Surgeons and Plastic & Reconstructive breast cancer surgeons need to be knowledgeable in advanced oncoplastic reconstruction techniques and be familiar with NAC anatomy. Preoperative Breast MRI provides an objective vascular roadmap enabling the multidisciplinary team to design a safe, individualized reconstruction plan that minimizes ischemic risk and maximizes aesthetic success.

Keywords

Breast, Cancer, Reconstruction, Lumpectomy, Oncoplastic Breast Surgery

1. Introduction

The role of the Plastic & Reconstructive Surgeon in the oncologic planning of breast cancer surgery has evolved significantly over the past decade as oncoplastic (lumpectomy) and autologous (mastectomy) reconstruction has become more popular [1]-[7]. The senior author on the paper (BPD) spent a significant portion of his career learning to circumvent and find solutions for the challenges of mastopexy in the previously augmented patient [8]. We previously published our experience using breast MRI with contrast to evaluate the remaining blood supply to the nipple areola complex and evaluate the thickness of the soft tissue in the previously augmented patient [2].

As our practices have matured and include both aesthetic breast surgery and breast cancer reconstructive surgery, we applied the techniques we learned in secondary mastopexy to that of oncoplastic reconstruction of lumpectomy defects. The simple premise of our approach to oncoplastic breast reconstruction is to create as few random pattern skin flaps as possible and maintain as many axial pattern blood flaps as possible. The more axial pattern flaps in the reconstruction, the more robust the blood circulation to the breast parenchyma. We believe that the breast will tolerate radiation better in this environment and provide a more amenable environment for the placement of a mammary prosthesis in the future if needed.

This stepwise process has been developed over time from self-education, tumor board discussions, conferences as well as knowledge passed down from mentor to fellow and inter-discussion among colleagues. Just as importantly, this step-by-step process is the direct result of the amalgamation of our own success, failures, re-operation, and complications addressed through the reconstructive process. In this paper, we describe our previous methodology using breast MRI to anatomi-

cally delineate the blood supply to the nipple areolar complex and assess flap thickness in aesthetic patients. We now expand the application to oncoplastic reconstruction [2]. We have found great similarity in the operative planning between the aesthetic patient and the reconstructive patient. The patient in this case report had atypical ductal hyperplasia (ADH) with a high suspicion of ductal-carcinoma in-situ (DCIS) yet it is a representative example of a common clinical scenario encountered in the oncoplastic reconstruction of lumpectomy defects when treating patients with breast cancer.

2. Methods

A 48-year-old patient with a history of rheumatoid arthritis and lupus underwent right breast lumpectomy for biopsy proven ADH in the setting of an approximate span of 66 mm of calcifications with a high suspicion of DCIS, right oncoplastic reconstruction, and contralateral left mastopexy (**Figure 1**).



Figure 1. 48-year-old female who presented with suspicious right breast lower inner quadrant calcifications.

Her diagnostic mammogram and ultrasound revealed calcifications in the lower-inner quadrant of the right breast spanning approximately 66 mm, a mass in the left breast at 10 o'clock which was considered benign, and scattered simple and complicated cysts in the left breast which were considered benign. Bilateral axillary lymph nodes were benign and likely reactive secondary to the patient's lupus and rheumatoid arthritis. The patient underwent stereotactic core needle biopsy of the right breast lower inner quadrant that returned as atypical ductal hyperplasia and flat epithelial atypia with calcifications.

Breast MRI revealed a right 19 mm post biopsy hematoma with associated tissue marker and mild surrounding enhancement, consistent with known FEA/ADH abutting the medial skin in the lower inner quadrant (BI-RADS 4). The

left breast was negative for malignancy (BI-RADS 2, benign). Multigene cancer panel testing, to include BRCA1 and BRCA2, was negative with no clinically significant variants detected.

We planned for lumpectomy and oncoplastic reconstruction in the event there was DCIS or invasive cancer in the specimen. A right breast split Wise-pattern oncoplastic reconstruction (**Figure 2(a)**, **Figure 2(b)**) was planned creating an inner quadrant lumpectomy defect (**Figure 3**). A left breast mastopexy was performed for symmetry. Intraoperative specimen radiography confirmed adequate wire-localized excision and complete removal of all calcifications (**Figure 4**). Final surgical pathology returned as breast tissue with a spectrum of proliferative columnar cell changes with foci of atypia identified best classified as multifocal FEA with focal ADH. There was no DCIS present in the surgical specimen.

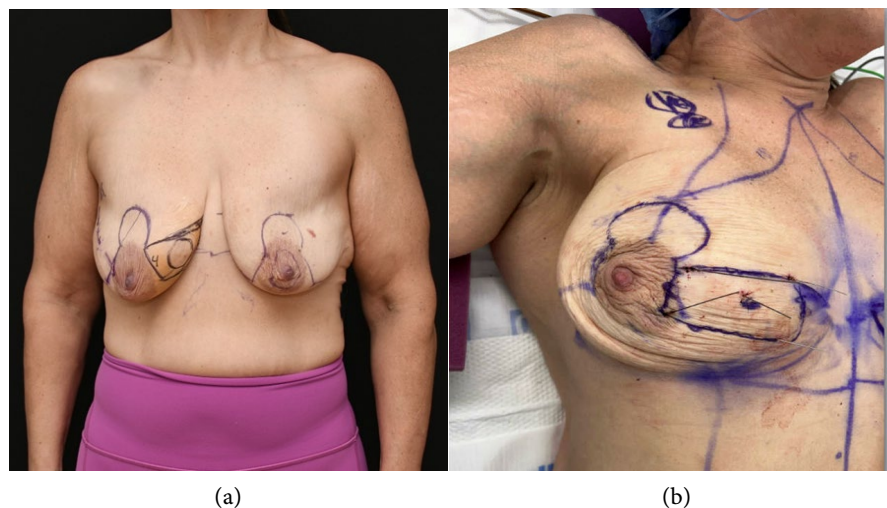


Figure 2. (a) A right breast split oncoplastic reconstruction was planned creating a right inner quadrant defect. (b) The on table markings showing the final area of atypia to be excised on the breast.



Figure 3. The right inner quadrant calcifications were marked with wires and excised. The edges of the wires are palpated to ensure adequate specimen resection.

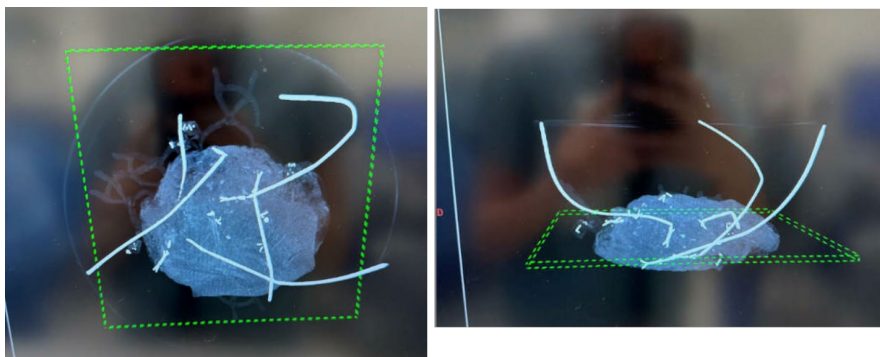


Figure 4. Specimen radiograph showing adequate excision with all calcifications being included in the specimen radiograph.

3. Results

Communication is paramount between the oncologic surgeon, the plastic & reconstructive surgeon, and the radiologist as it pertains to operative planning. The first step in our planning sequence is a “surgical flight plan” (**Figure 5**) that is designed by the oncologic surgeon after initial consultation with the patient [1]. The “surgical flight plan” is then shared with all appropriate physicians involved in the care of the patient. The surgical flight plan locates the area to be resected, the extent of resection, and how it will be localized. The surgical flight plan helps the plastic surgeon to approximate the anticipated volume of tissue resection, determine whether skin will be excised, and evaluate the quality of the remaining soft tissue and its blood supply.

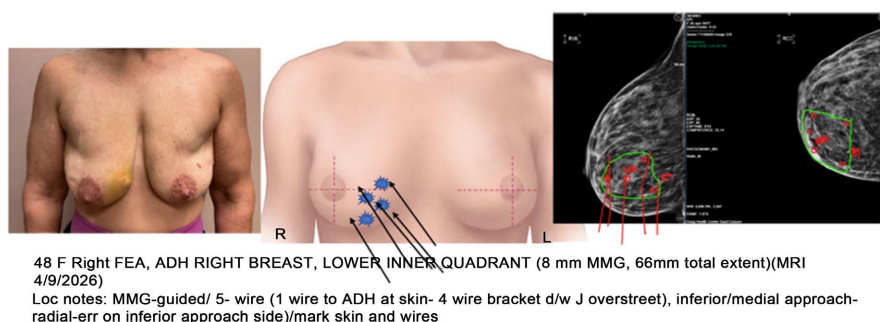


Figure 5. The surgical flight plan includes a pre-operative photograph of the patient obtained at the time of the ultrasound guided biopsy. The second component of the flight plan is a cartoon diagram demonstrating the location of the tumor or DCIS on the breast as well as a depiction of the direction and placement of marking wires on the breast. A mammogram depicting the position of the calcifications on the breast are an integral part of the flight plan.

The plastic & reconstructive surgeon will review the surgical flight plan produced by the oncologic surgeon prior to seeing the patient in consultation and examining the patient. Prior to meeting the patient, we find it is helpful for the plastic surgeon to review all breast imaging alone and then in conjunction with the radiologist so that the early career plastic and reconstructive surgeon can start

to develop his or her own intuition and begin the journey of understanding surgical “cause and effect”. Surgical cause and effect is one of the most important principles and concepts for the young surgeon to understand. After reviewing the images and examining the patient, the plastic surgeon will start to answer and address the questions below in a stepwise manner.

1) Step 1.

Question 1. Is the patient ptotic? What grade is the ptosis?

The first step in the skin markings for oncoplastic reconstruction is to determine if the patient is ptotic or not. In the ptotic patient a variation of the Wise or inverted T incision as described previously is used [1]. The degree of ptosis is determined by the position of the nipple relative to the inframammary fold (**Figure 6**). The markings commence with a vertical line drawn from the sternal notch superiorly and extending inferiorly through the xiphoid process. The next mark is at the location of the IMF a horizontal line extending from the inframammary fold of each breast directed toward the vertical line drawn from the sternal notch through the xiphoid process. This is our reference to determine ptosis (**Figure 6**). Our patient’s nipple areola complex was below the level of the fold but not on the lowest hemisphere of the breast making her breasts a Grade II ptosis (**Figure 7**).

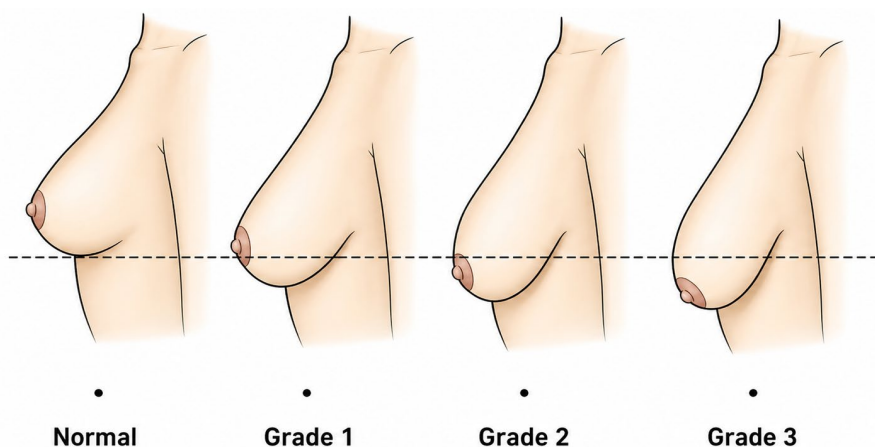


Figure 6. The first step in oncoplastic reconstruction is to determine the degree of ptosis of the breast. The degree of ptosis (Normal, Grade I, Grade II, or Grade III) is determined by the position of the nipple relative to the inframammary fold. A youthful breast is defined as a breast where the nipple areolar complex is positioned above the inframammary fold and a Grade III ptosis is defined as a breast where the nipple areolar complex is below the level of the fold and on the lowest hemisphere of the breast.

2) Step 2.

Question 2. Where is the tumor? Is it close to the nipple? Is it close to the skin based on MRI?

The breast MRI protocol: Multiplanar multisequence imaging was performed through bilateral breasts and axillae before and after the administration of intravenous gadolinium contrast using a 1.5T MRI scanner with a dedicated breast coil. Images were reviewed with the aid of CADstream post processing and CAD soft-

ware. Motion correction, subtraction, 3D MPR/MIP, and angiogenesis mapping techniques were utilized by the interpreting radiologist. The vascular branches were identified by the Plastic & Reconstructive Surgeon author. (BD)

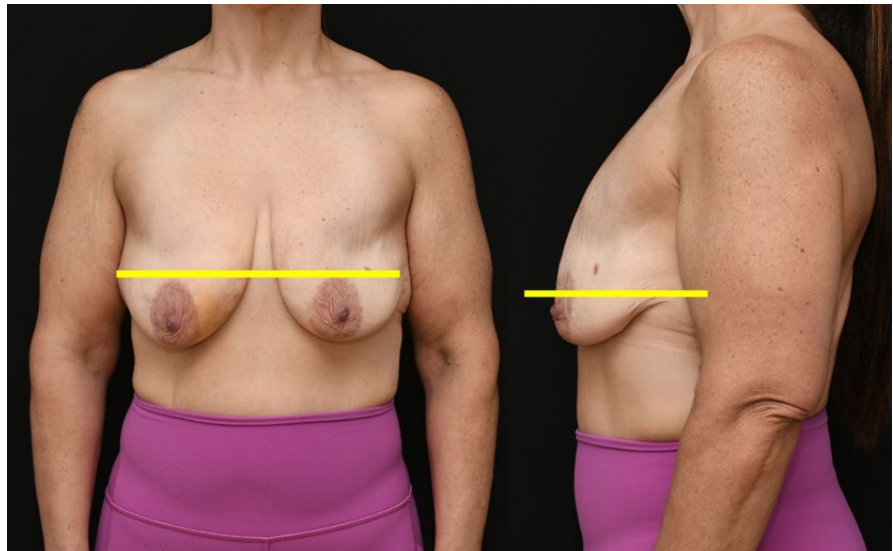


Figure 7. The yellow line demarcates the position of the nipple areolar complex relative to the inframammary fold (IMF). In this patient the nipple areola complex (NAC) was positioned below the IMF but not on the lowest hemisphere of the breast classifying the breasts as a Grade II ptosis.

The breast MRI is often the starting point for our triangulation discussion. During the MRI, the patient is placed prone in the MRI machine and the skin tends to drape farther away from the tumor than when the patient is standing or if the patient were lying supine as if they were on the operating room table. The bilateral breast MRI in this case demonstrated a subcutaneous hematoma and the biopsy showed atypia in close proximity to the skin. Locating the biopsy hematoma can be an effective procedure to locating the region of skin that needs to be excised (**Figure 8**). This allows us to understand our ability to 1) clear an anterior margin and 2) keep robust skin flaps of the surrounding breast skin and obviate the need to create thin avascular skin flaps by trying to remove the tumor from beneath the skin. This is the first step and our rationale in the skin markings that we believe helps to produce the most aesthetic reconstruction possible and allows the skin to tolerate radiation in the future if necessary and optimize the success of accepting an implant for flap reconstruction (**Figure 9**).

3) Step 3.

Question 3. Where is the tumor? Is it close to the nipple? Is it close to the skin based on mammography?

The mammogram views are our second step for our localization discussion. During the mammogram the patient is standing upright in the mammogram machine. The mammographic views tell us additional information regarding the need to remove skin over the tumor [6]. In the craniocaudal (CC) view, we can

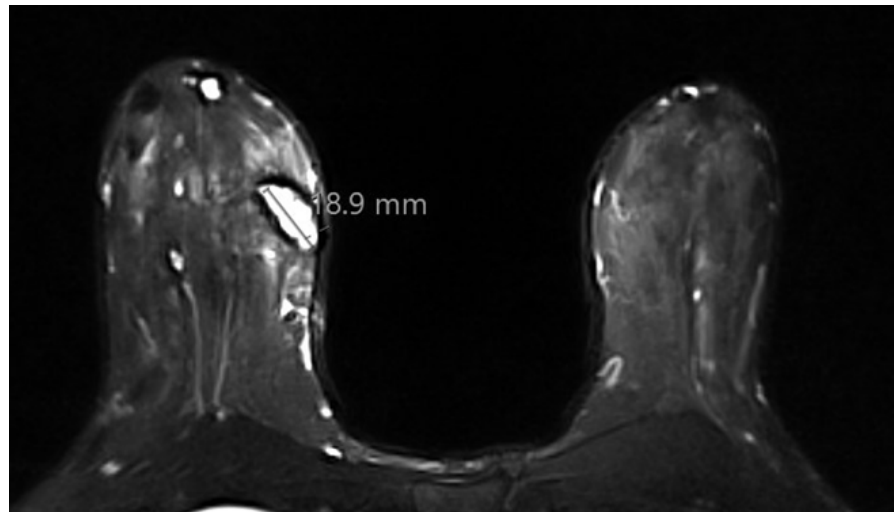


Figure 8. The breast MRI post biopsy often reveals a post-biopsy hematoma that allows for identification of the location of resection.



Figure 9. The bilateral breast MRI denotes the position of the post biopsy hematoma. This is often palpable immediately after but can disappear or become less easily palpable prior to surgery. The core biopsy skin puncture site can help lead to the area of skin to be excised. This is marked on the skin and then adjusted to a split reduction if the location lies outside the position of the Wise pattern marking.

locate the medial or lateral nature of the tumor. In these compressed views, the skin may also appear farther from the tumor or calcifications than it actually is. We use this view to see if a Metzenbaum scissor can adequately pass between the skin edge and the edge of the calcifications and still either clear the margin or leave healthy skin. The mediolateral (ML) view (**Figure 10**) is often the premise for whether we remove the skin above the tumor and then keep the remaining skin with a hearty blood supply.



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While there is a significant amount of pre-operative planning, on the day of surgery the wire localization view can on occasion change the surgical approach. The wires may now appear closer to the nipple areola complex than originally planned or wires may now come closer to the skin than originally planned.

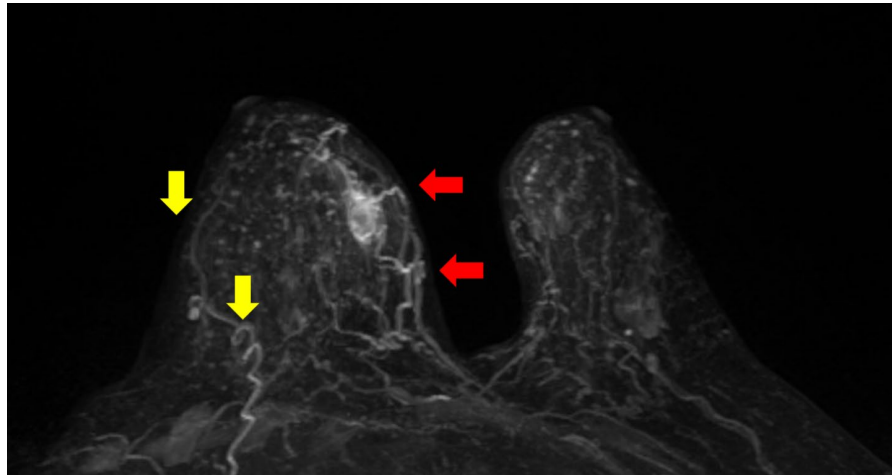


Figure 11. The blood supply to the NAC predominately arises from the perforating branches off the internal mammary artery that pierce the pectoralis muscle along its medial border. The secondary blood supply arises from the lateral thoracic artery. To evaluate the remaining blood supply to the nipple areola complex we evaluate the breast MRI maximal intensity projection subtraction Views. In our patient we can see the medial perforating branches extending through the area of the atypia (Red Arrow). This predominant medial branch will be sacrificed with the resection of the atypia. The remaining blood supply after resection will arise from the less dominant lateral artery (Yellow Arrows). It is important to keep this artery within the pedicle after resection to maintain NAC viability.

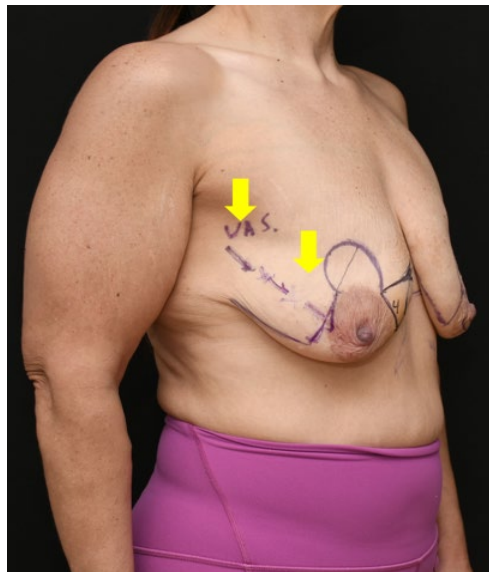
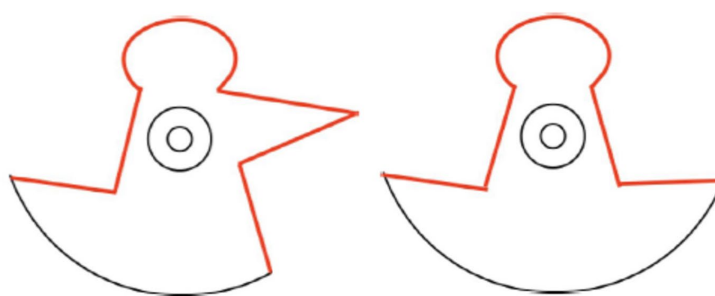


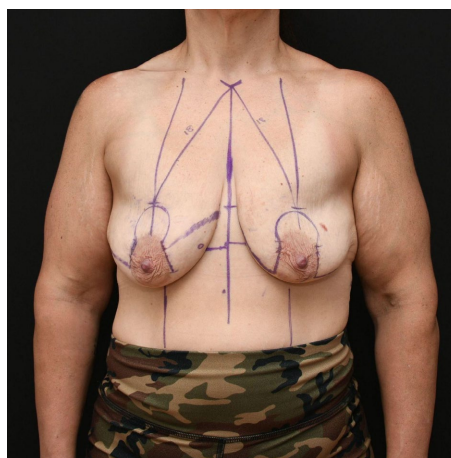
Figure 12. The lateral thoracic artery and lateral blood supply is dopplered and traced to the nipple areolar complex pre-operatively. Great care is taken to ensure that minimal undermining occurs in this direction. Depithialization can take place but knife or Bovie electrocautery is limited to only the subcutaneous portion which in this patient is very thin < 4 mm.

It is important for both the Oncologic Breast Surgeon as well as the Plastic & Reconstructive Surgeon to review the wire localization images as markings may need to be adjusted or optimized to facilitate the oncologic resection or help preserve

the nipple areola complex blood supply. The final markings are then concluded with any adjustments based on wire location. The top of the new nipple areolar complex position is marked approximately 5 cm cephalad to the IMF. In patients in whom a closure may be difficult, the top of the nipple areola complex is shifted downward. The Wise pattern is marked in the usual fashion for those tumors that lie within the confines of the excision pattern. When the tumor lies outside of the traditional Wise pattern, as it does in this case, a split reduction is employed to remove the skin over the tumor (**Figure 13(a)**, **Figure 13(b)**). We have described our oncoplastic reconstruction markings in our previous publication [1]. The patient was happy with her final result after right breast lumpectomy with oncoplastic reconstruction and left breast mastopexy for symmetry (**Figure 14**). To date the patient has been followed for 3 months and there have been no NAC or skin ischemia, delayed healing, infection, or reoperation. There was no DCIS identified on pathology and no adjuvant radiotherapy occurred.



(a)



(b)

Figure 13. (a) The Wise pattern is marked in the usual fashion for those tumors that lie within the confines of the excision pattern. When the tumor lies outside of the traditional Wise pattern, as it does in this case, a split reduction is employed to remove the skin over the tumor. (b) The Wise pattern is marked in the usual fashion for those tumors that lie within the confines of the excision pattern. When the tumor lies outside of the traditional Wise pattern as it does in this case, a split reduction is employed to remove the skin over the tumor.



Figure 14. At one week post-operatively, the skin is well healed and there are no signs of infection or hematoma. The nipple areola complexes are viable bilaterally and the incisions appropriately display hyperemia.

4. Discussion

Breast reconstruction is challenging. It requires a multidisciplinary surgical approach with excellent communication among the team of radiologists, oncologic breast surgeons, and plastic & reconstructive surgeons. The more effective and multi-modality the communication is, the better each participant can understand the other person's goals and concerns. Listening to these concerns can help minimize re-operation and complications and improve aesthetic outcomes.

The common question that arises during lumpectomy and oncoplastic reconstruction is, "Is the tumor close to the skin?". The answer to this question is almost invariably, "Yes!" The breast derives from ectoderm, the origin of skin and skin appendages [9] (**Figure 15**). As a direct embryological and anatomical result, the skin and subcutaneous tissue is intimately involved with the breast parenchyma. It is a much easier surgical dissection to remove the breast off the pectoralis muscle compared to elevating the skin off of the breast gland uniformly (**Figure 16**). One can argue that it is easier to de-epithelialize the epidermis of the dermis, but uniform thickness of skin flaps is challenging. Even more so in the patient with thin subcutaneous tissue beneath the skin. In these patients and almost all patients, we prefer to remove the skin over the tumor and leave the adjacent skin with robust skin flaps and possible remaining axial pattern blood supply.

An important principle in our reconstructions is the maintenance of axial pattern flaps when possible. The axial pattern flap has the most robust blood supply and in our experience tolerates radiation significantly better than random pattern flaps (**Figure 17**). These are principles as plastic surgeons that we aim to teach to oncologic breast surgeons, fellows, colleagues, etc. as blood supply is not a significant component of the general surgeons curriculum-just as cancer is not a significant component of the plastic surgeons' curriculum. A mastectomy is a pure example of a random pattern blood supply (**Figure 17**). The musculocutaneous perforators have been sacrificed with the mastectomy specimen and the remaining

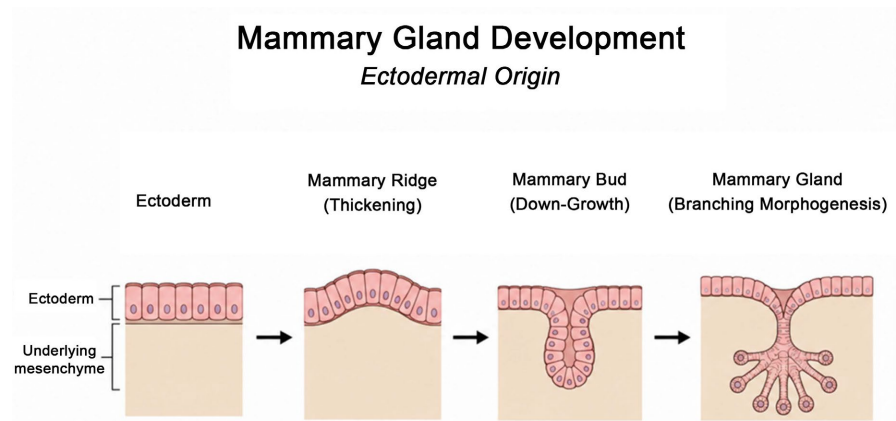


Figure 15. The breast derives from ectoderm and grows toward the mesoderm. By nature of its origin the breast is intimately involved with the skin and the skin appendages.

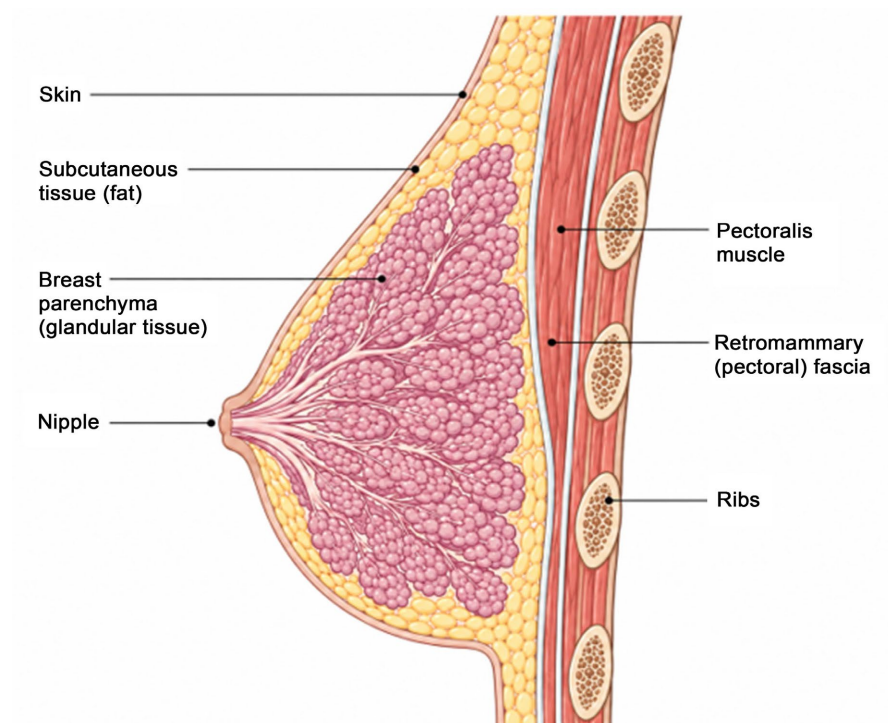


Figure 16. The skin and subcutaneous tissue is intimately involved with the breast parenchyma. It is a much easier surgical dissection to remove the breast off the pectoralis muscle. It is challenging to elevate the skin off of the breast gland uniformly.

blood supply is what travels through the subdermal plexus protected by the subcutaneous tissue. This pattern of blood supply is the least tolerant of radiation changes and more likely to result in a more obvious appearance of having been radiated. Therefore, our thought process follows in a lumpectomy, we aim to keep as much of the axial pattern blood supply of the breast intact as this will tolerate radiation better and maintain a healthier appearance after radiation and hopefully an environment amenable to an implant if needed to correct volume defects on the radiated side.

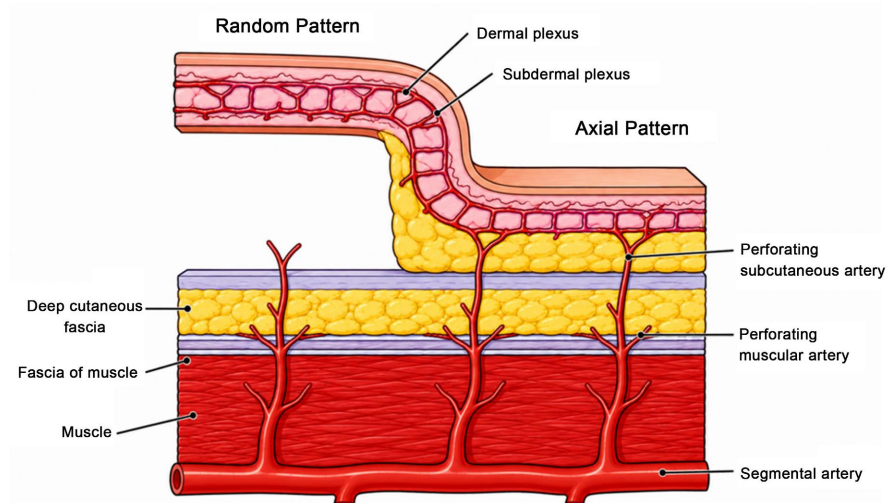


Figure 17. An axial pattern flap has a direct arterial blood supply perforating the muscle or fascia, extending through the subcutaneous tissue to perfuse the skin. In addition the venous return is intact which allows the return of blood flow by way of the subdermal plexus and/or back down through the musculocutaneous or fasciocutaneous perforators. The random pattern flap which occurs during a mastectomy has an arterial and venous drainage that can only rely on the subdermal plexus as the arterial and venous perforating vessels have been sacrificed. This skin is the least tolerant to radiation and the most likely to have radiation changes. In concept then, we try to maintain as many perforators and create as few random pattern flaps for our lumpectomy reconstructions which receive radiation more frequently.

We understand our limitations regarding our claims about radiation tolerance, future implant feasibility, and repeat-lumpectomy applicability as these outcomes were not directly evaluated in this case. More importantly, prior aesthetic or oncologic surgery and radiotherapy may alter vascular anatomy. Often these operative reports are unobtainable for myriad reasons and even more so these patients will require individualized vascular anatomic planning with breast MRI.

5. Conclusion

Blood supply is an important principle in Plastic & Reconstructive surgery. It is important to maintain viability of aesthetic units and to preserve the integrity of the skin. As oncoplastic reconstruction after lumpectomy becomes more popular and as the indications for radiation become less stringent, we may see more opportunities for repeat lumpectomies to treat recurrence disease. Prior knowledge of blood supply in previous operative reports may be challenging to track down. The contrast enhanced breast MRI provides an objective approach to evaluate the remaining blood supply to the NAC allowing surgeons to create a safe reconstructive plan.

Ethics Approval and Consent to Participate

The data collection for the publication was completed via chart review and a case report format. Informed consent, obtained from all patients, for photographic

consent was obtained in written form for all patients.

Consent for Publication

All participants provided written consent for their use of photographs for presentation and publication. Patients are not identified by name in any photographs or text. Patients are aware that in some circumstances, the photographs may make their identity recognizable. In addition, patient identifying information has been removed from images and faces are omitted from photographs.

Availability of Data and Material

The chart and photographic review material are available from chart review from the office of Brian P. Dickinson, M.D., Inc.

Consent to Participate

Photographic consent was obtained from the patients in the chart review for presentation and publication.

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There was no funding for the completion of the chart review or preparation of the manuscript.

Author Contributions

The manuscript work presented has not been published before and it is not under consideration for publication anywhere else. The publication has been approved by all co-authors, as well as by the institute where the work has been carried out.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Dickinson, B.P., Holmes, D., Vu-Huynh, N., Vu, M.B., Snyder, L., MacDonald, H., *et al.* (2020) Autologous Mastectomy Reconstruction: Communication among the Breast Surgery Team to Maximize Aesthetic and Oncologic Outcome. *The Breast Journal*, **26**, 1771-1780. <https://doi.org/10.1111/tbj.13874>
- [2] Dickinson, B.P., Vu, M.B., Silverstein, M., Prajapati, K.P., Lopez, J., Li, E.D., *et al.* (2022) Preoperative MRI to Improve Aesthetic Outcomes in Secondary Mastopexy Augmentation: A Step-by-Step Approach. *Aesthetic Surgery Journal Open Forum*, **4**, ojac068. <https://doi.org/10.1093/asjof/ojac068>
- [3] Dickinson, B.P. and Handel, N. (2012) Approaching Revisional Surgery in Augmentation and Mastopexy/Augmentation Patients. *Annals of Plastic Surgery*, **68**, 12-16. <https://doi.org/10.1097/sap.0b013e3182110ff3>
- [4] Silverstein, M.J., Mai, T., Savalia, N., Vaince, F. and Guerra, L. (2014) Oncoplastic Breast Conservation Surgery: The New Paradigm. *Journal of Surgical Oncology*, **110**, 82-89. <https://doi.org/10.1002/jso.23641>

- [5] Dickinson, B.P., Patel, A., Pham, J., Huynh, N.V., Vu, M.B., et al. (2020) Autologous Flap Reconstruction as a Unique Opportunity for Weight Loss and Breast Cancer Risk Reduction: A Case Report. *International Journal of Radiology and Radiation Oncology*, **6**, 17-21.
- [6] Brian P, D., Nikkie, V.B., Monica B, V.B., Gregory, S., Judy Pham, R., Ayushi Patel, B., et al. (2021) Internal Mammary Node Positivity and Autologous Mastectomy Reconstruction: Implications for Breast Cancer Treatment and Aesthetic Outcome. *International Journal of Radiology and Radiation Oncology*, **7**, 14-21. <https://doi.org/10.17352/ijrro.000045>
- [7] Ashjian, N., Mehrabi, C., Dickinson, B., et al. (2025) Coexistence of a Malignant Phyllodes Tumor of the Breast with Heterologous Elements (Osteosarcoma and Chondrosarcoma) and Invasive Ductal Carcinoma: Case Report and Review of the Literature. *Journal of Breast Cancer Case Reports (JBCCR)*, **1**, 106.
- [8] Handel, N. (2006) Secondary Mastopexy in the Augmented Patient: A Recipe for Disaster. *Plastic and Reconstructive Surgery*, **118**, 152S-163S. <https://doi.org/10.1097/01.prs.0000246106.85435.74>
- [9] Lteif, A. and Javed, A. (2013) Development of the Human Breast. *Seminars in Plastic Surgery*, **27**, 5-12. <https://doi.org/10.1055/s-0033-1343989>