Chapter

Oncoplastic Surgery in Breast Cancer

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Abstract

Oncoplastic surgery is an emerging approach which combines breast-conserving surgery and plastic surgery techniques. It aims to provide wider volume resection with oncologically clear margins and at the same time to maintain the breast shape and optimize cosmetic outcomes. Inspired from esthetic breast surgery techniques, oncoplasty consists of breast volume displacement to fill the defect of large resections and optimize the cosmetic outcomes without interfering with the oncoplastic safety. In this chapter, the concept, indications, and principles of oncoplastic techniques used in conservative breast surgeries will be exposed. A photo-based atlas for oncoplastic incisions will concern seven cases starting with the preoperative planning and marking and ending up with the long-term postoperative outcomes.

Keywords: breast cancer, oncoplasty, oncological safety, cosmetic outcome

1. Introduction

During the last century, breast surgery has witnessed a tremendous evolution leading to radical changes in surgical concepts and standards. In 1894, William S. Halsted published the first results of the known "Halsted radical mastectomy" which consisted of en bloc resection of all suspected tissues including all breast tissue, axillary lymph nodes, and both pectoral muscles [1]. This technique lasted for more than 50 years until Patey and Dyson have introduced the modified radical mastectomy with sparing of the pectoralis muscles [2]. Later in the 1970s with the introduction of the radiotherapy in the management of breast cancer, we started to abandon the "fits all" mastectomy approach as we demonstrated the equivalency of breast-conserving surgery when combined to radiotherapy in comparison to mastectomy. With the comparable survival and recurrence rates between the two approaches published by the Milan trials and the National Surgical Adjuvant Breast and Bowel Project (NSABP) B-04 trial, we entered a new era in the breast cancer management and shifted the paradigm away from the psychological burden that was associated with the mastectomy [3, 4]. Gradually the breast-conserving surgery combined with radiotherapy has become the preferred approach in the case of early breast cancer cases however with high rates of poor cosmetic outcomes (30–40%) and residual deformities, especially when larger volume excision is needed. The failure of classical breast-conserving surgery

techniques has anticipated the development of new approaches to improve cosmetic outcomes as well as patient satisfaction. From this ideal, the oncoplastic surgery was born in the last two decades [5].

2. Definition and concept

Oncoplastic surgery is a new approach that combines surgical oncological principles with plastic surgical techniques. It aims to provide wide tumor excision with an immediate reshaping of the remaining breast tissue using many forms of remodeling techniques. The goal of oncoplastic surgery is to completely remove the lesion with clear margins and with good to excellent cosmetic result in one definitive procedure [6]. This novel technique does not compromise the oncological safety. At the contrary, it proves good oncological efficacy in terms of margin status and recurrence in comparison to traditional breast-conserving surgery techniques. This could be related to the large breast volume excision and consequently safe margins that this technique provides [7–10]. It is worthy to note that the surgeon can perform this approach with sentinel lymph node biopsy or axillary lymph node dissection.

3. Principle

Before deciding if a patient is eligible to undergo an oncoplastic surgery, we need to consider three factors: excision volume, tumor location, and glandular density [11].

First of all, excision volume is the most predictive factor for poor outcomes. It was suggested that excision of >20% of breast tissue could impair the breast shape and lead to a poor cosmetic outcome [12, 13]. With oncoplastic techniques, the surgeon can remove an average of 200 g up to 1000 g and without interfering with the natural breast shape [14]. A remodeling of the adjacent remaining breast tissue enables the surgeon to fill the defect created by the tumor resection. A preoperative assessment of the breast volume and tumor size as well as a proper evaluation of the imaging findings guides the surgeon in his operative decision.

Second, the tumor location plays an essential role in guiding the incision type and the size of volume excision. For example, correcting a defect after removing a tumor from the upper outer quadrant is easier in comparison to a defect in the upper inner quadrant where less breast tissue is available to be mobilized [11].

Third, the breast density guides the extent of breast undermining and reshaping. A breast with high fat composition limits the tissue manipulation and mobilization and may expose to higher rates of complications especially fat necrosis. A preoperative mammographic evaluation aids in the breast density assessment and helps the surgeon in his operative choice [11].

Additional factors to be considered are:

- The fat content in the axillary area in the case of resection in the outer quadrants
- The size of the breast and its implication on the extent of volume excision
- The grade of ptosis

- The associated clinical conditions, especially smoking, uncontrolled diabetes, or older age that may interfere with the healing process and lead to higher complications rates [15]

4. Preoperative planning

The success of an oncoplastic procedure starts with a good and reasonable preoperative planning. The first issue to be considered is the estimated volume of the tumor relative to the overall breast [15]. Imaging modalities play an important role in the evaluation of the local extent of disease in patients with breast cancer.

Performing a magnetic resonance imaging (MRI) preoperatively helps the surgeon in assessing the extent of disease especially in the case of dense breast tissue. The sensitivity and specificity of MRI are 93–100% and 26–91%, respectively [16–18]. MRI also helps to identify lesions on the contralateral side. Besides, it is useful for the detection of multifocal or multicentric lesions and consequently may alter the surgical management [19]. In a meta-analysis, the authors found that 8.1% of patients were converted from breast-conserving therapy to mastectomy and 11.3% of patients were converted from breast-conserving therapy to more extensive surgery after performing an MRI [20]. Another benefit is that MRI enables the surgeon to assess the amount of fat and dense breast tissue. The surgeon must reconsider both the incision type and the need for mobilization when planning the operation in the case of mostly fatty breasts due to the increased rate of fat necrosis in this type of breasts when manipulated too much.

MRI alone is not sufficient for decision-making and should be combined with mammography. MRI in addition to mammography is an accurate tool to determine the suitability for a breast-conserving surgery. Although MRI predicts the possibility of conservative treatment, this can be improved with the addition of mammography which may increase the extent of the disease compared to that seen on MRI due to the visualization of microcalcifications [21]. Moreover, digital breast tomosynthesis (DBT) has emerged recently as a novel approach permitting to reduce the obscuring effect of overlying breast tissue and to overcome the limitations of the regular mammogram [22–24]. Also integrating the tomosynthesis in the preoperative work-up may increase the diagnostic accuracy of mammographic lesion evaluation and improve the breast cancer staging significantly in patients with dense breasts compared to conventional mammography alone [25, 26].

A mammogram is always complemented with ultrasound examination to localize the mammographic and tomographic lesions. Ultrasound-guided biopsies are needed to confirm the diagnosis as well as to evaluate the axillary lymph node status. Suspicious lymph nodes are evaluated with needle biopsy [6]. Also, wire localization of the tumors is mostly done under ultrasound guidance preoperatively. Sometimes, multiple wires are needed to guide the surgeon in the extent of the resection [27].

Preoperative planning also requires the case presentation in the tumor board where a multidisciplinary team is involved in the decision-making. Oncologic surgeon, radiologist, pathologist, oncologist, radiation oncologist, and others may be included [6]. For a better outcome, the patient can also be implicated in the operative decision.

5. Techniques

Many techniques of oncoplastic incisions were described in the literature. It is not a one technique fits all. In every case, the surgeon needs to take into consideration the tumor size, the volume of the breast, the grade of ptosis, the age of the patients, and other factors without compromising the oncologic safety. Many techniques may be applicable for every tumor location. An experienced surgeon in oncoplastic surgery will be able to decide which technique will provide better oncological as well as cosmetic outcomes. We will cite the most commonly used techniques, and then we will expose photos of the markings as well as postoperative outcomes of seven cases.

We need to distinguish between two types of oncoplastic techniques:

1. Reconstruction of the breast from local breast tissue which may include:
    a. The rotation techniques (rotational/advancement flap) (case 1, 2 and 4)
    b. B-plasty
    c. Tumor-adapted reduction mammoplasty: for lower quadrant lesions, also in the case of severe ptosis (case 3)
    d. Central quadrantectomy
    e. Round block or volume displacement technique in the case of periareolar lesions
2. Reconstruction of the breast using adjacent fat tissue, for example:
    a. Quadrantectomy or hemimastectomy with a latissimus dorsi flap (case 5)
    b. Quadrantectomy or lumpectomy with thoraco-epigastric flap (rarely used), (case 6)

5.1 Case 1

5.1.1 Description of case 1

The tumor is located in the upper inner quadrant (**Figure 1a**). First, the tumor is resected with the skin over the tumor bed (**Figure 1b**). The status after resection of the full thickness arriving at the major pectoralis muscle is shown in **Figure 1c**. After that, the skin in the axillary area is removed (**Figure 1d**). This step can also be done at the beginning when the sentinel lymph node should be removed. Then, the tissue is mobilized medially, and the flap is remodeled in the defect area (**Figure 1e** and **f**). As a last step, the skin incision is extended to perform the mastopexy in order to recentralize the nipple-areolar complex (NAC) (**Figure 1g**). Finally, the wound is sutured with 3.0 Monocryl running sub- and intracutaneously (**Figure 1h**).

Figure 2a shows how the skin and flap tissue are medially mobilized after resection of the tumor and removing of the sentinel lymph node. For a better symmetry, the incision is extended to realize a mastopexy (**Figure 2b**).

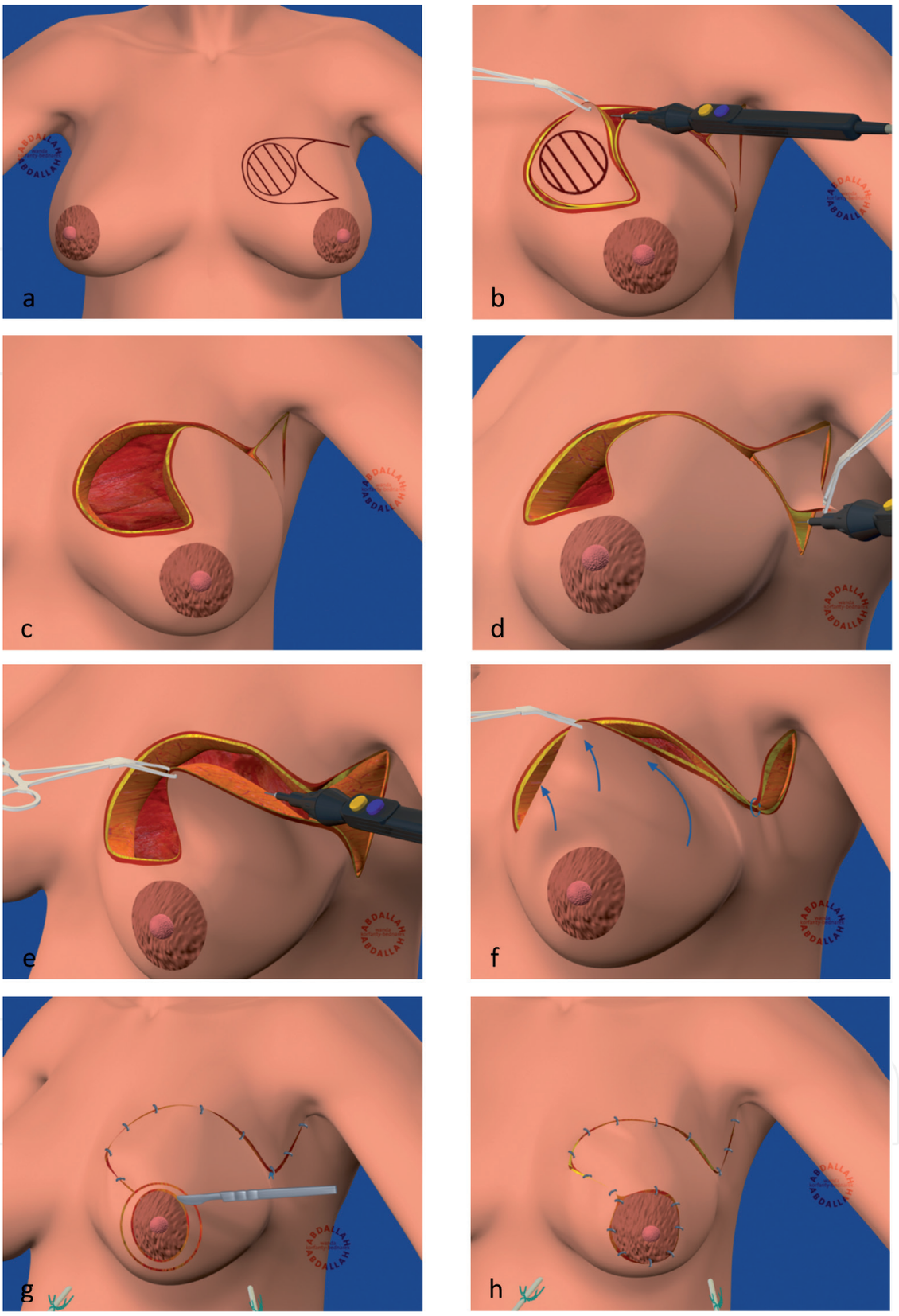

Figure 1.
Step-by-step illustration of tumor resection in the upper inner quadrant followed by reconstruction with a rotational flap.

Figure 2c presents the status after the adaptation of the wound and performance of a mastopexy for better optimization. The postoperative result is shown in **Figure 2d**.

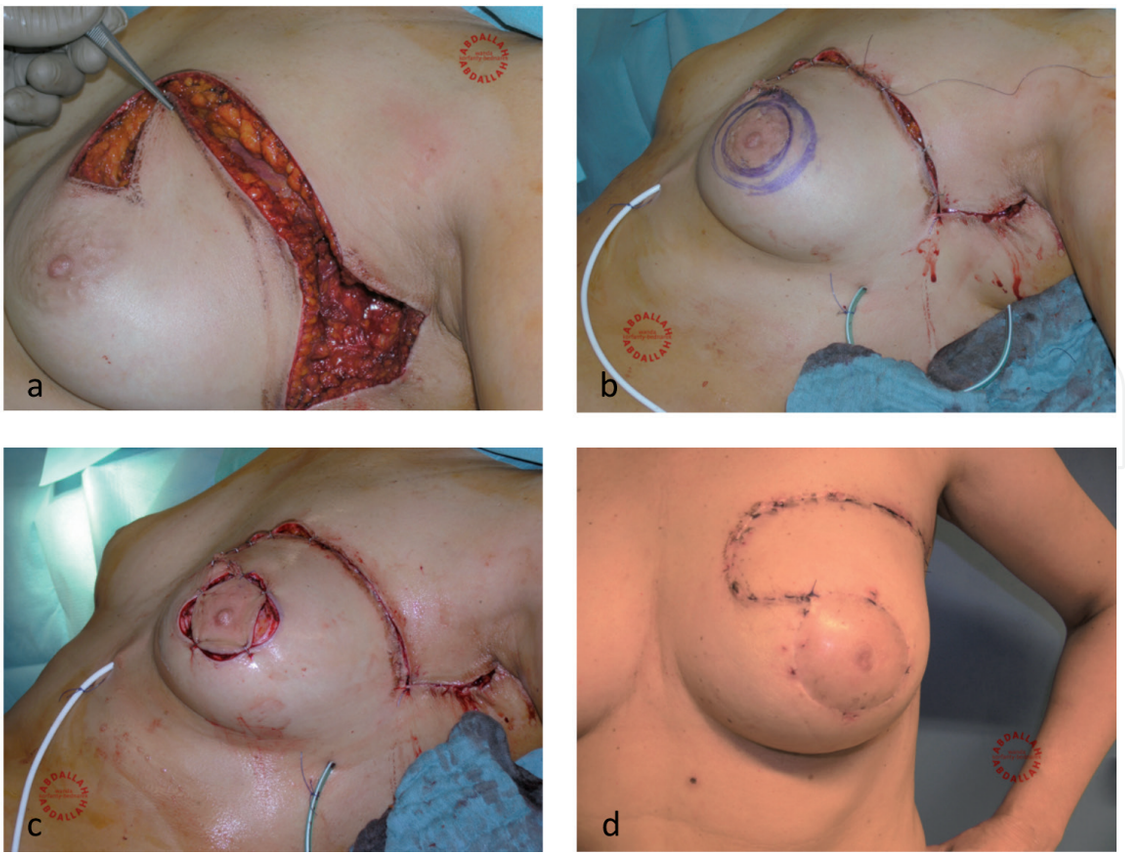

Figure 2.
Intraoperative photos and the postoperative result after resection of the tumor in the upper inner quadrant.

5.2 Case 2

5.2.1 Description of case 2

In this case, the tumor is located in the right inner quadrant around 4 o'clock (**Figures 3a** and **4a**). In order to gain additional tissue from the caudal area and to increase the volume of the flap, the incision line is performed 1.5 cm under the inframammary fold (**Figures 3b** and **4a**). After the incision along the marking, the tumor is resected together with the skin leaving a huge defect in the medial area (**Figures 3c** and **4b**). Following tumor resection, the gland tissue is mobilized from the pectoral fascia cranially until the level of the NAC (**Figure 3d**). The extent of mobilization is well shown in **Figure 3e**. Then, the skin over the inframammary fold is removed permitting to rotate the caudal part of the flap inwardly and consequently to gain more volume (**Figure 3e** and **f**). The flap is rotated in the medial area to fill the defect (**Figure 3g**). Finally, the NAC is recentralized after adaptation of the wound (**Figure 3h**). The postoperative outcome is shown in **Figure 4c** and **d** [28].

5.3 Case 3

5.3.1 Description of case 3

Figure 5a shows the preoperative drawing that is usually used in the case of a tumor-adapted reduction mammoplasty. The operation starts with the resection of the NAC and the whole tissue thickness underneath it to the muscle (**Figures 5b** and **6a**). An important issue to be considered at this time of the operation is to leave all around a minimum of 0.5 cm chorion when removing the NAC bloc so that the future areola sits

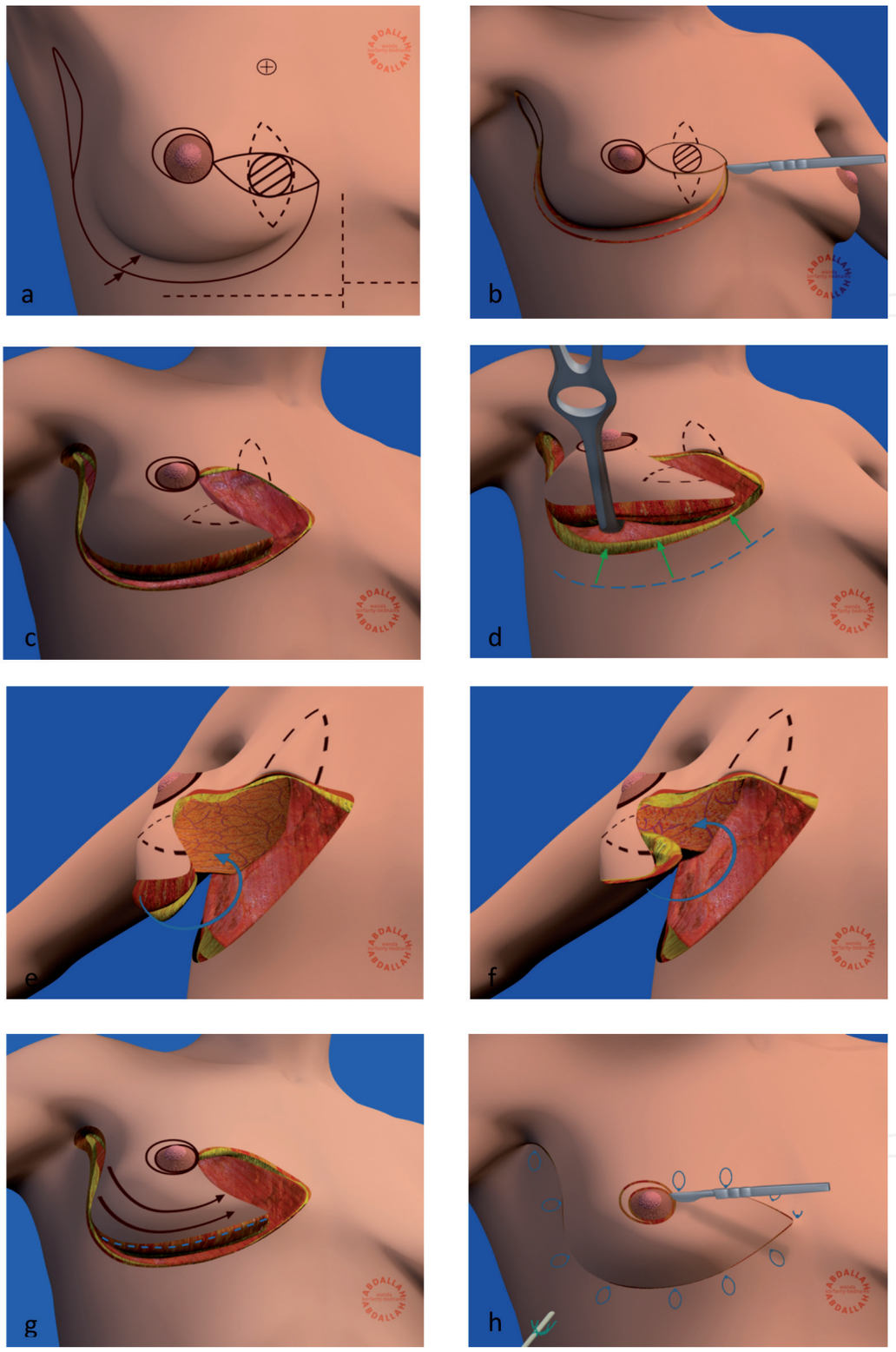

Figure 3.
Step-by-step illustration of tumor resection in the inner quadrant followed by reconstruction with a rotational flap.

on it (tip) (**Figures 5c** and **6b**). Then, the preparation of the flap will be started. The surgeon needs to perform a deepithelization of the skin leaving a skin island, which will be the newly formed areola (**Figure 6c**). After that, the flap is mobilized medially, laterally, and caudally (**Figure 5d** and **e**). At this level, the flap is only basally stalked (**Figure 5f**). Finally, both sides of the wound are adapted (**Figure 6d**), and the final result will be as shown in **Figure 6e** and **f**. The areola position is supported through the left chorion. Otherwise, the NAC can sink into the defect area.

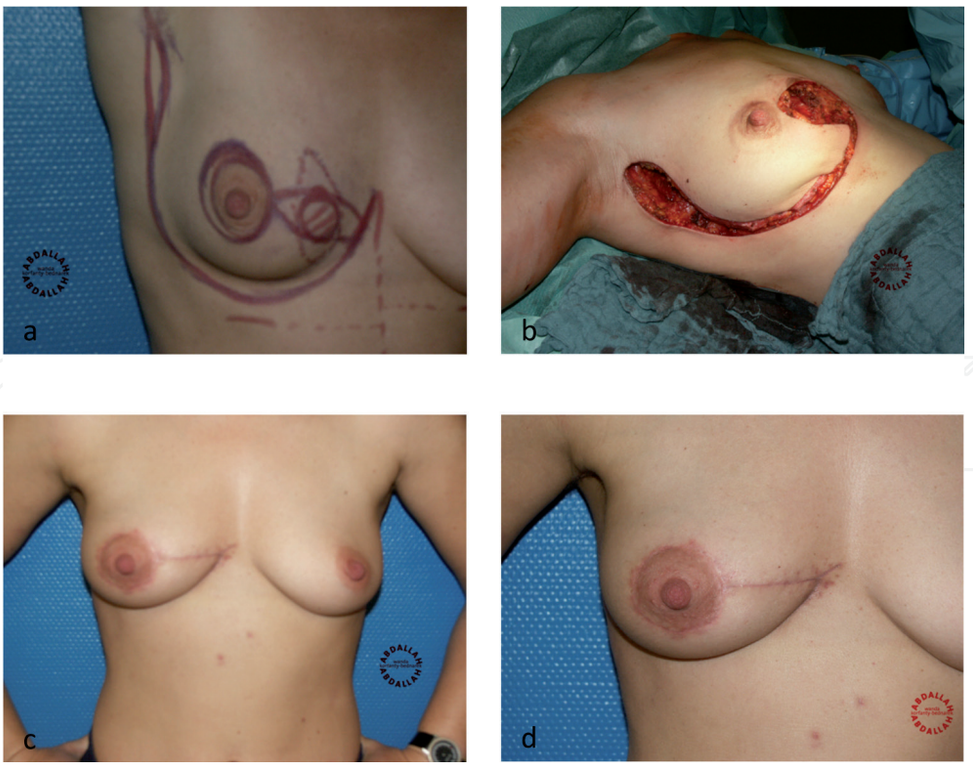

Figure 4.
Intraoperative photos and the postoperative result after resection of the tumor in the inner quadrant.

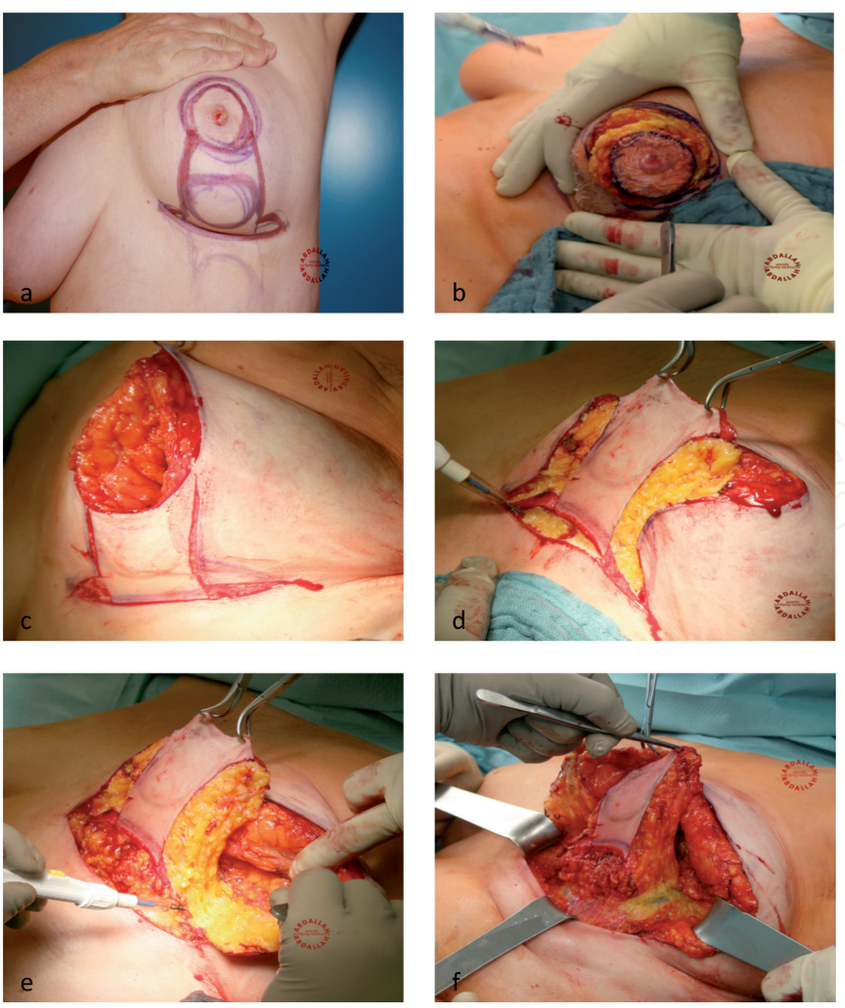

Figure 5.
Intraoperative photos illustrating the steps of tumor-adapted reduction mammoplasty (a–f).

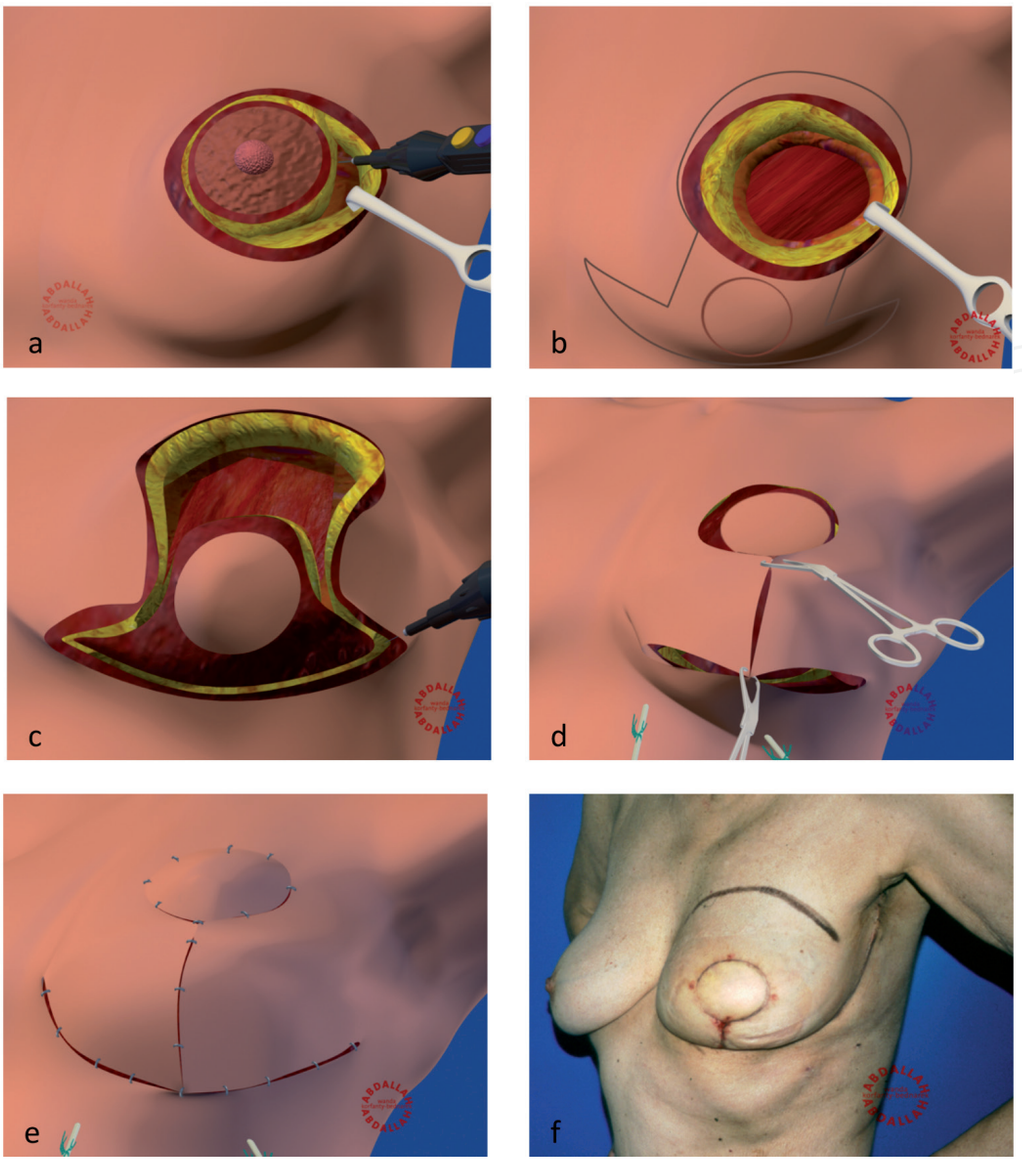

Figure 6.
Illustration of central resection and remodeling of the breast using a flap from the caudal area. Postoperative outcome is shown in (f).

5.4 Case 4

5.4.1 Description of case 4

The tumor location and the preoperative incision marking are shown in **Figure 7a** and **b** (front and side). The previously marked area is resected leaving a defect in the breast segment where the tumor was located (**Figure 7c** and **d**). After removing the tumor, the breast tissue is mobilized from the caudal as well as the axillary area to fill the defect. Both sides of the wound are adapted together. The reshaping of the breast is completed by performing a mastopexy to recentralize the nipple-areolar complex.

5.5 Case 5

5.5.1 Description of case 5

In this case, the patient first received a breast-conserving surgery for breast cancer on the right side. The initial tumor was resected in free margins. On the

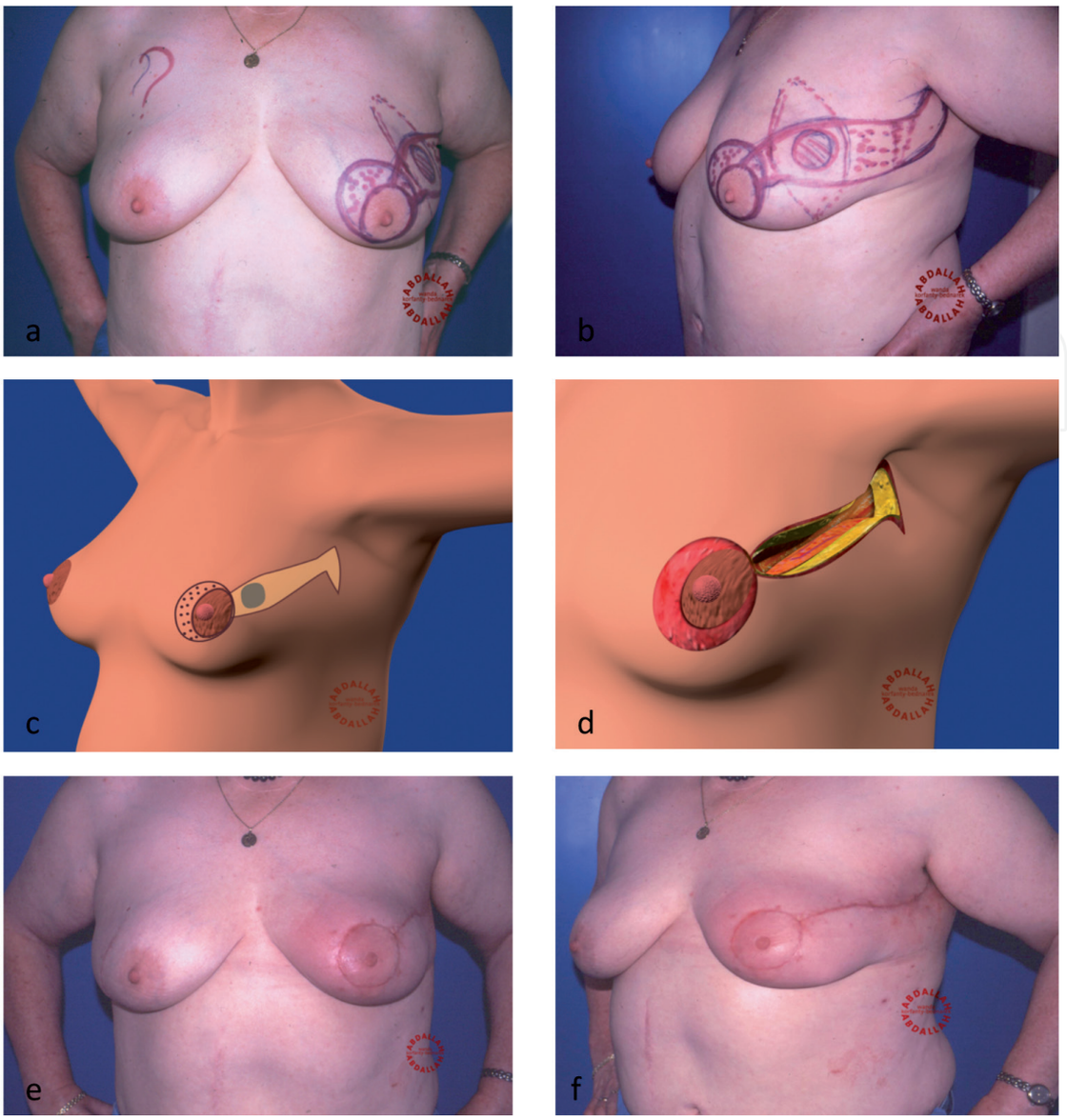

Figure 7.
Drawings of tumor resection in the left upper outer quadrant with the postoperative outcome.

final pathology, ductal carcinoma in situ (DCIS) components were incidentally found on the lateral margins making the first surgery a R1-resection. A hemimastectomy was indicated to ensure a R0-resection. The extension of the resection is shown in **Figure 8a** and **b**. The incision marking on the back is shown in **Figure 8c** and **d**. After the hemimastectomy, the fat tissue is mobilized and separated from the lateral thoracic wall arriving at the latissimus muscle edge (**Figure 8e** and **f**). Then, the latissimus skin and fat island with the underlying muscle is mobilized and transposed in the breast defect area (**Figure 8g**). After fixation of the mobilized caudal tissue on the major pectoral muscle, the flap is adapted to the wound edges (**Figure 8h**). The postoperative result was as shown in **Figure 9a** and **b** [28].

5.6 Case 6

5.6.1 Description of case 6

In this case, the patient has previously received breast-conserving surgery followed with radiotherapy for breast cancer. She presented at our clinic for a defect in the

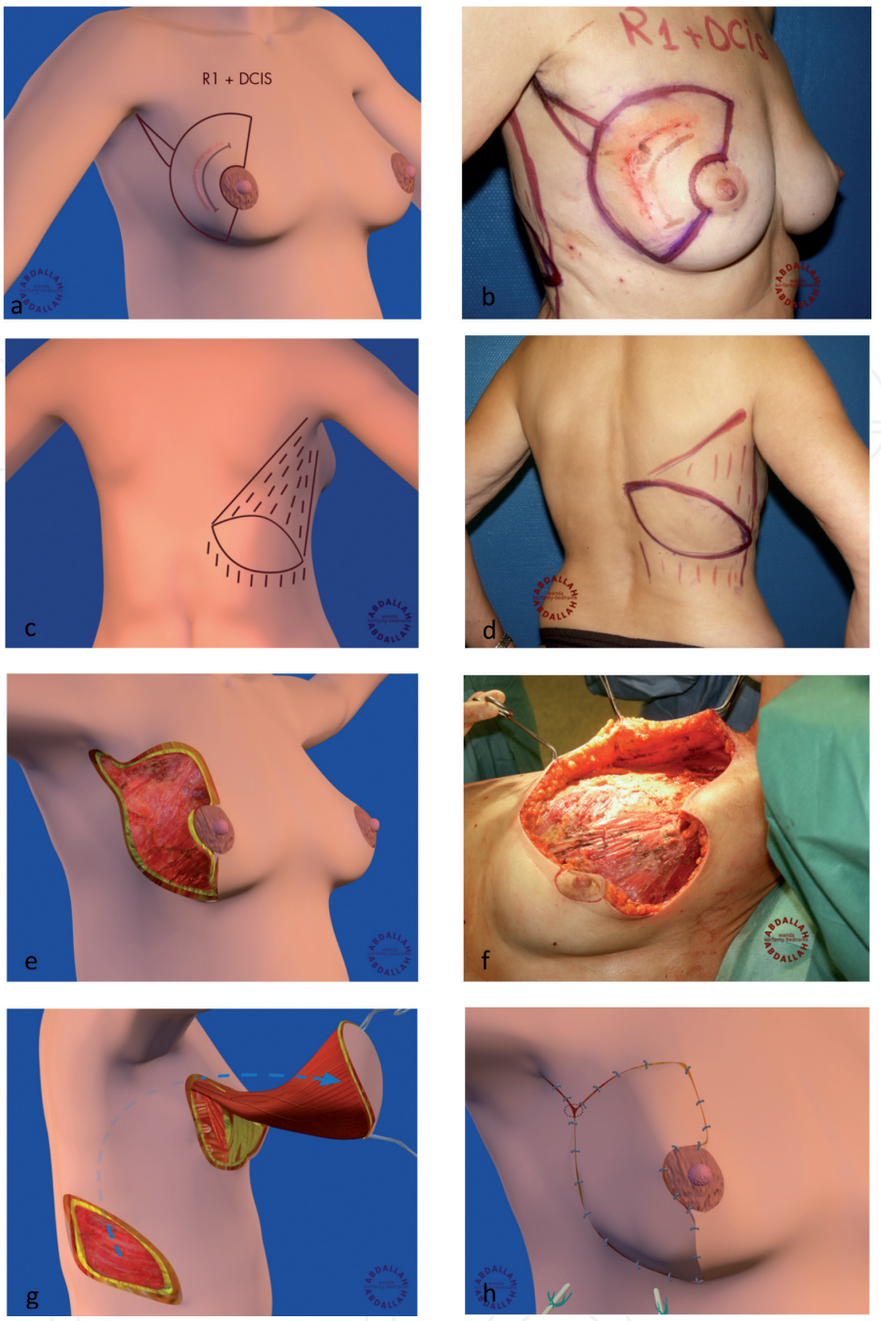

Figure 8.
Step-by-step illustration of a right hemimastectomy followed by reconstruction with a latissimus dorsi flap.

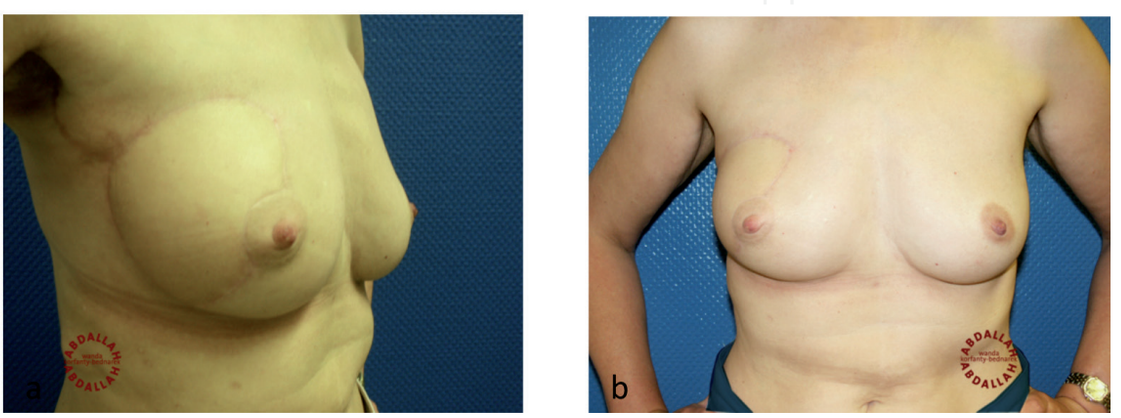

Figure 9.
Postoperative outcome after reconstruction of the hemimastectomy defect with a latissimus dorsi muscle flap.

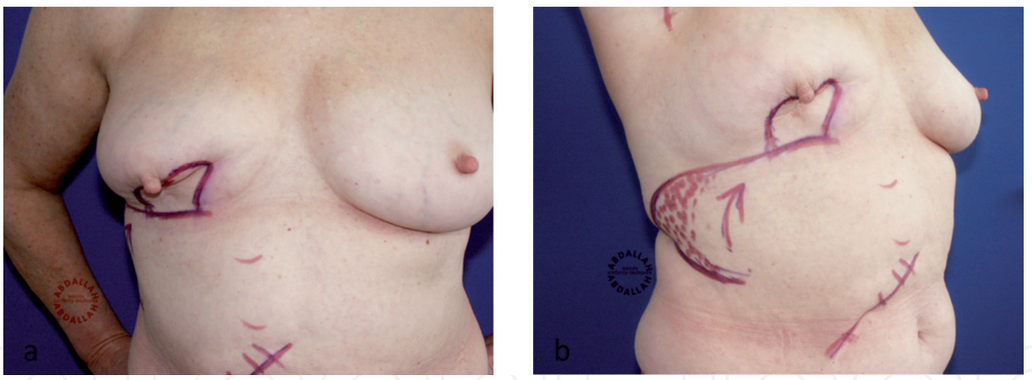

Figure 10.
Preoperative incision drawing in a patient presenting a defect in the inferior quadrant after receiving a breast-conserving surgery and radiotherapy for breast cancer.

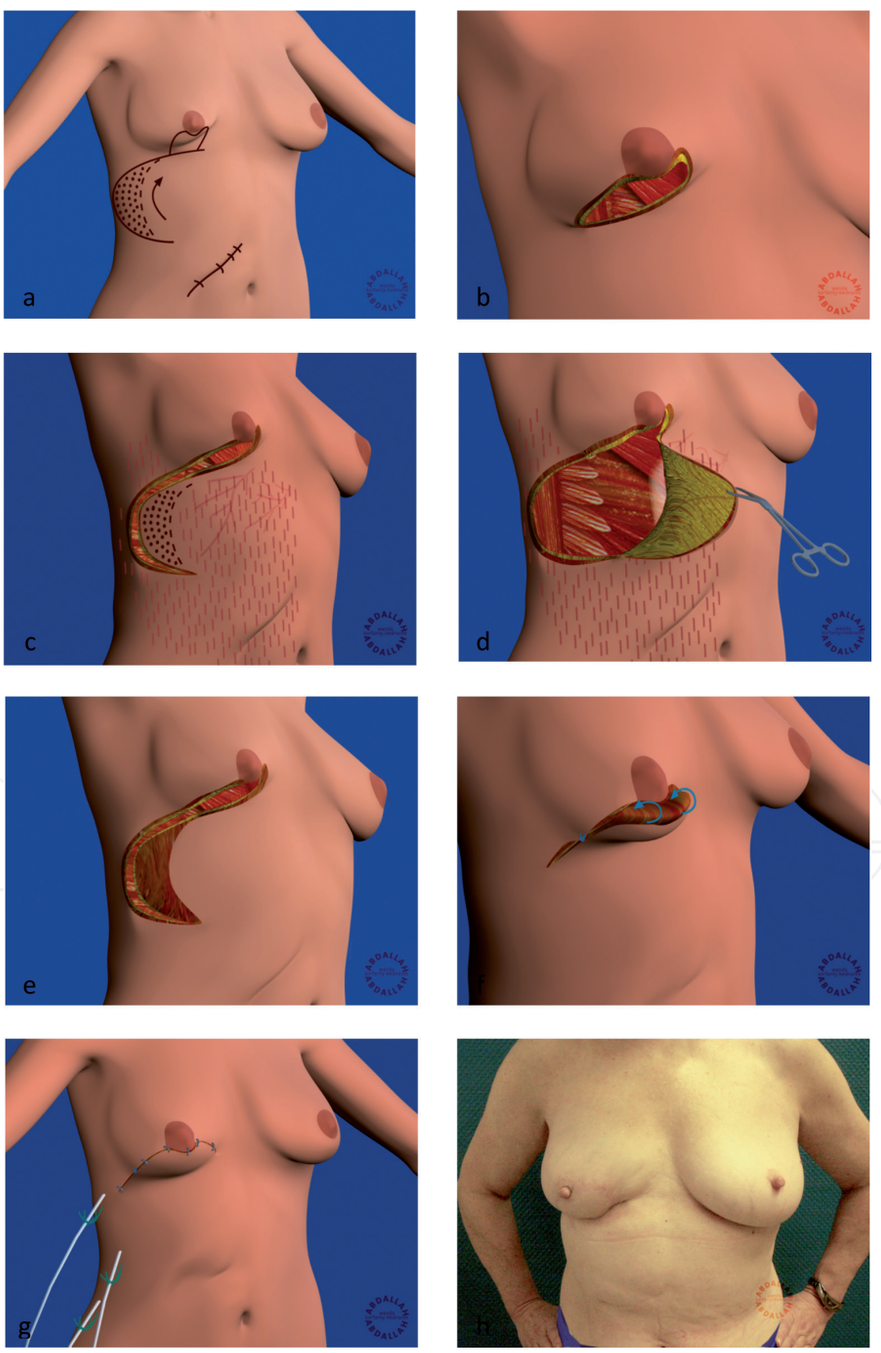

Figure 11.
Step-by-step illustration of reconstruction of lower breast defect with a thoraco-epigastric flap.

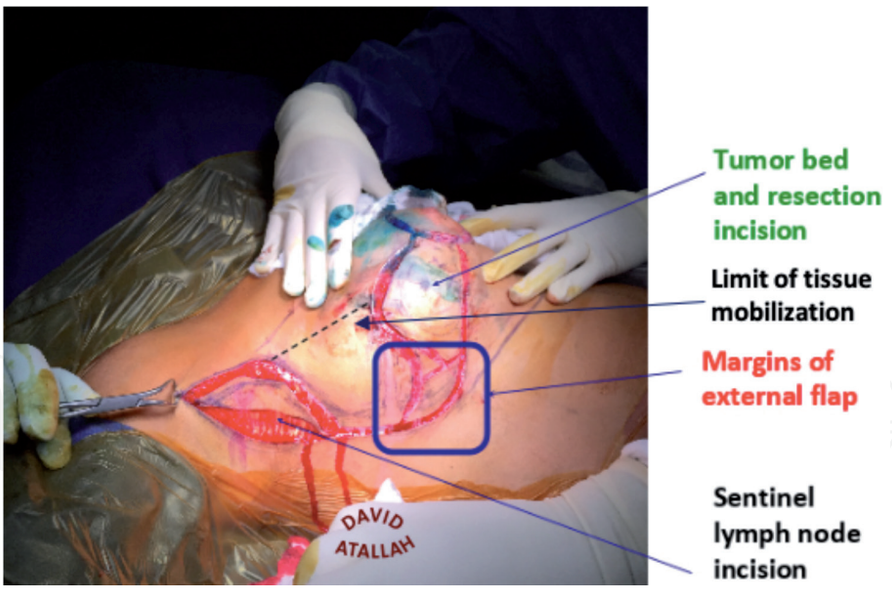

Figure 12.
Tumor located at the union of outer quadrants and using the lateral fat to fill the defect. An intraoperative photo showing the resection incision, the borders of the lateral fat flap to be used as well as the incision for the sentinel lymph node.

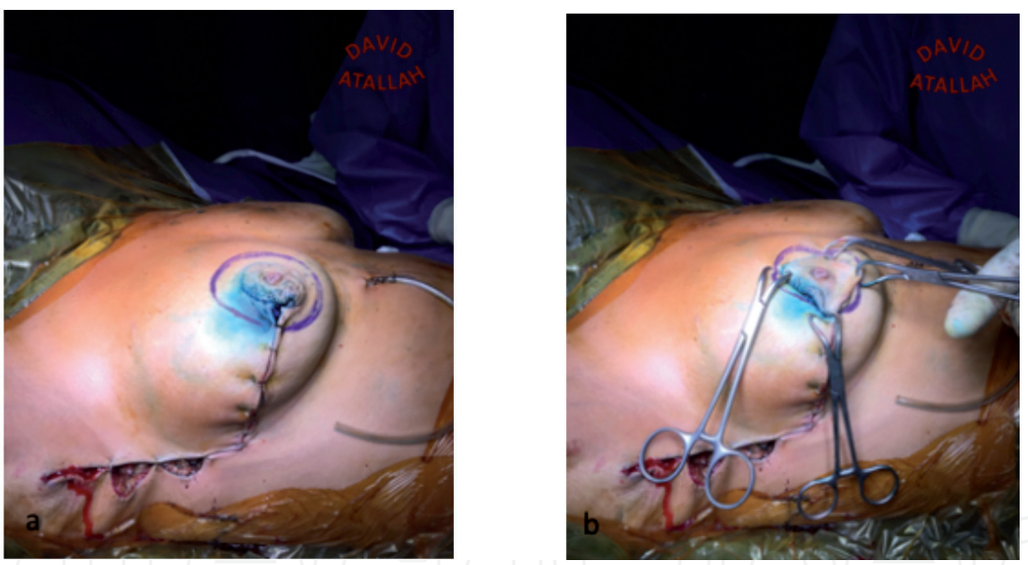

Figure 13.
An intraoperative photo showing the status after remodeling of the breast and adaptation of the wound. The drawing of the mastopexy and the checking of the mastopexy limits using Backhaus towel clamps are shown in **Figure 14a** *and* **b**, *respectively.*

operation area accompanied with pain. She was planned for removal of the scarred tissue and defect coverage with a thoraco-epigastric flap. The drawings in **Figure 10a** and **b** show the breast area to be removed and also the flap that needs to be mobilized. The lower marked scar is an old open cholecystectomy scar (**Figure 11a**). First, the scarred area is removed as shown in **Figure 11b**. Second, the incision is extended laterally and then inferiorly as preoperatively marked permitting to harvest the intended flap (**Figure 11c**). Then, the upper abdominal flap is mobilized and separated from the abdominal wall. The scar of the cholecystectomy is as well dissected. The red dots show the extension of the mobilization (**Figure 11d**). The black dots show the skin area which is deepithelialized and inserted in the wound area (**Figure 11c** and **e**). The flap is transposed, and the deepithelialized area is inserted in the defective areal and fixed on

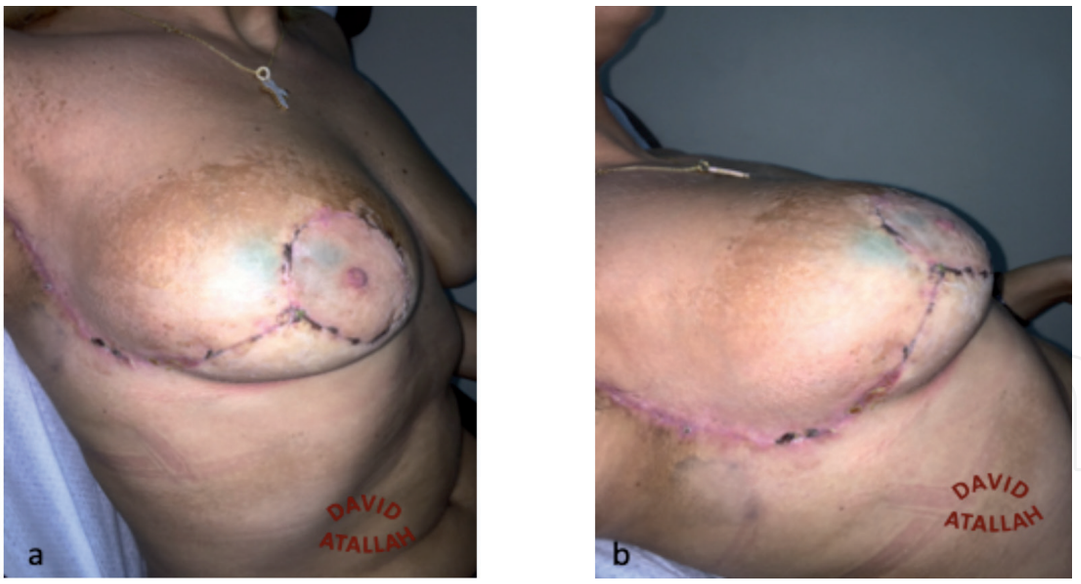

Figure 14.
Postoperative outcome after outer quadrant breast resection and reconstruction using oncoplastic technique.

the pectoral fascia (**Figure 11f**). The status after adaptation of the wound and postoperative result are shown in **Figure 11g** and **h** [28].

5.7 Case 7

5.7.1 Description of the case

In this case, we want to raise the attention on the importance of sparing every centimeter of fat tissue that could be used and mobilized when trying to fill the defect created after a wide breast excision.

After resection of the tumor, we can use an external fat flap that will be deepithelialized and then mobilized internally to contribute to a better form of the remodeled breast (**Figure 12**). The flap is mobilized internally and then covered by both glandular pillars (superior and inferior) (**Figure 13a**). In the last step, the NAC is recentralized using mastopexy (**Figure 13b**). The postoperative result after 2 weeks is as shown in **Figure 14a** and **b**.

6. Complications

Massive breast mobilization and recentralization of the nipple during oncoplastic surgery cause tissue trauma, large wound surfaces, and surgical dead space, which may increase the risk of complications [29].

First, some complications are frequently seen after an oncoplastic surgery. Actually, the manipulation and mobilization of the breast may compromise the blood supply of flap tissue and make it prone to present fat necrosis in 5% of cases. Sometimes the fat necrosis may impair the ability to adequately screen for tumor recurrence and can be mistaken for a suspicious lesion or local recurrence which may require more tissue sampling procedures in order to rule out malignancy [30]. In addition, seroma formation is commonly seen after oncoplastic surgery. The presence of seroma may also delay the delivery of adjuvant therapy and may be seen in 8–10% of cases. Wound healing can also be protracted in patients receiving oncoplastic surgery in comparison to standard surgery especially in the case of smoking history. Moreover,

asymmetry can also be an issue after oncoplasty [31]. However, an adjustment of the contralateral side can always be offered especially when the size difference between the two sides is remarkable. Also, there is a risk of nipple malposition in the case of lack of mastopexy when needed. Loss of nipple sensitivity can occur and may be related not only to nipple-areolar complex manipulation but also to radiotherapy effect.

Second, other complications can occur after oncoplasty but may rarely be observed. For example, partial nipple necrosis or complete nipple loss can be a devastating complication for both the patient and surgeon in 0.5% of cases. That is why it is essential to select wisely the patients, the safest possible technique, and encourage them to reduce risk factors. In the case of very thin flaps, skin necrosis can be expected. The radiotherapy after the oncoplastic surgery can occasionally lead to breast deformity especially in the case of mostly fatty very-low-density breasts. Patients with smoking history, uncontrolled diabetes, or postoperative infection are prone to develop breast fibrosis.

Last but not the least, special concern should be made when combining oncoplastic surgery with intraoperative radiotherapy because these cases were associated with a high risk of fat necrosis in our patients collectively. Also, a particular attention should be given when operating slim women with small breasts. Due to the small available volume, the reshaping of the breast cannot be sufficient resulting in deformity and NAC malposition.

7. Conclusion

The introduction of oncoplastic surgery has helped to optimize esthetic outcomes in breast cancer management without compromising oncological safety. Along with wider volume resection, this technique can also maintain breast shape and appearance. Indeed, an excellent postoperative outcome starts with a preoperative planning done by an experienced surgeon who will take into consideration the breast volume, tumor size and location, breast density, and patient's age and comorbidities. It is not a one technique fits all, but it is about the capability of blending art and science in every case individually based on the mentioned principles.

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