

Oncoplastic Surgery: A Creative Approach to Breast Cancer Management

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KEYWORDS

- Oncoplastic surgery • Breast cancer
- Skin-sparing mastectomy • Reconstruction

HISTORICAL PERSPECTIVE

History has proved that in most cases, the treatment of breast cancer requires surgical intervention. Since Halsted's¹ original work in the late 1880s, the surgical management of breast cancer has instilled fear in women throughout the world, and breast surgery has been considered unpleasant but a necessary evil.² Although the radical mastectomy accomplished local control, the advanced stage of disease often led to poor survivability; thus, surgical change was not possible until the era of screening mammography and the subsequent shift to the detection of earlier, often nonpalpable, tumors. Fortunately, since that time, significant progress has been made in the surgical management of breast cancer.

Much of this work began in the mid to late 1970s, and after decades of diligent scientific research, surgeons were able to show that less-extensive tissue resection was possible without endangering a woman's life. The two most widely recognized clinical trials supporting this hypothesis are the Milan trials and the National Surgical Adjuvant Breast and Bowel Project. After more than 20 years of follow-up for each of these studies, clinicians have learned that various portions of the breast and surrounding structures can be preserved without having an impact on survival in a negative manner. During the course of these studies, however, it also became evident that surgery alone was not sufficient, and adjuvant treatment was necessary in order to achieve success with breast conservation surgery.^{3,4} **Fig. 1** illustrates the dramatic differences that result from various surgical approaches for resection of primary breast tumors, ranging from radical mastectomy to lumpectomy. Combining the process of early tumor detection with less-extensive tissue resection and adjuvant therapies allowed for the first major changes in breast cancer surgery to occur. In the

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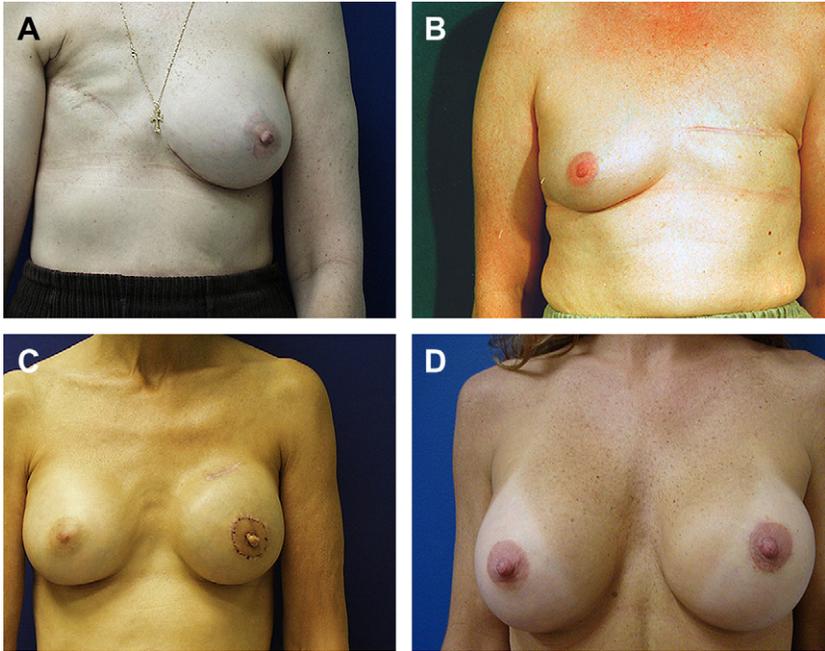


Fig. 1. (A) Standard radical mastectomy (note vertical skin incision). (B) Standard modified radical mastectomy (note horizontal skin incision, preservation of additional skin, and pectoralis major muscle). (C) Patient after left skin-sparing mastectomy, implant reconstruction, nipple reconstruction, and right breast augmentation mammoplasty for symmetry. (D) Patient after left breast lumpectomy (periareolar incision). Patient had subglandular augmentation mammoplasty many years prior to lumpectomy.

years that followed, these same advances contributed to the genesis of the field of oncoplastic, surgery, allowing for more and more creative, yet safe, surgical solutions (Fig. 2).⁵⁻⁸

The idea of combining knowledge from various subspecialties to create a comprehensive, individualized treatment plan was the modest beginning of the multidisciplinary patient-centered model.⁹ When considered separately, the advancements over the past several decades in each field, such as radiology, surgery, medical oncology, radiation therapy, and other fields, are impressive. When taken together collectively, however, the progression within each field allowed for clinical changes that are nothing less than extraordinary.

Given the widespread implementation of less-aggressive surgical resections (such as lumpectomy and sentinel lymph node biopsy), the interaction between surgeon, radiation oncologist, radiologist, pathologist, and oncologist has become essential to achieving a good outcome. First and foremost, the objective is to design a surgical plan that does not compromise tumor resection or place patients at undo risk of local recurrence that might result in the need for multiple surgeries. The determination for how much tissue must be removed (from an oncologic perspective) cannot be separated from a thorough and complete preoperative assessment of both breasts, including consideration of breast size and shape and patient desires. In this regard, the basic principles of aesthetic and reconstructive surgery must be understood by the surgeon performing the extirpative procedure because placement of incisions

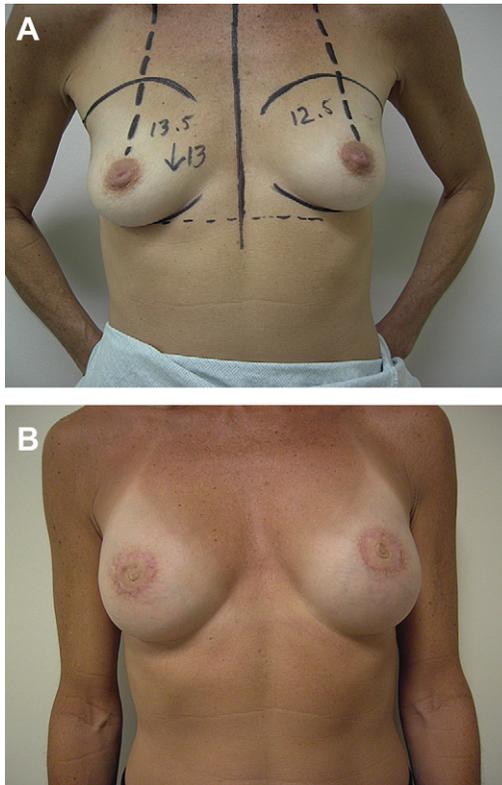


Fig. 2. (A) Preoperative photograph of patient with early breast cancer and positive for BRCA mutation. (B) Postoperative photograph of same patient after bilateral skin-sparing mastectomy, immediate breast reconstruction with saline implants (submuscular), and bilateral nipple reconstruction.

influences later options for reconstruction. Once full consideration is given to the surgical options and possible need for postoperative adjuvant therapy, an extensive discussion with patients helps define the most appropriate surgical plan.

Although studies show that local recurrence may not ultimately have an impact on overall survival rates, mortality is not the ultimate endpoint most women are trying to beat. Most women who have faced the reality of a diagnosis of breast cancer find it challenging to go through the experience, and most of them prefer not to endure the experience again. Thus, although the option of breast conservation brings with it the alluring possibility of avoiding bodily disfigurement (discussed previously), local resection alone is not as effective as mastectomy in reducing the risk of local recurrence. Thus, even in cases of early-stage breast cancer, radiation therapy and often chemotherapy are necessary when breast conservation is chosen instead of mastectomy. Given the widespread and long-standing aversion to mastectomy, however, breast conservation quickly became adopted by surgeons and women alike, and the addition of adjuvant therapies has been accepted when necessary. The reality and fear of local recurrence, however, remains a significant concern for many women, and many of these women opt for mastectomy instead of lumpectomy. Oncoplastic surgery can offer dramatic surgical improvements in this group of women, because

often methods of skin sparing, and sometimes even nipple-areolar sparing, can be offered in a safe and effective manner (see **Fig. 2**).^{7,8,10}

With the adoption of breast conservation, physicians soon found clinical follow-up of these patients challenging because lumpectomy and radiation can result in significant scarring of the breast. This resulted in the unfortunate dilemma of making clinical or mammographic examination of the breast difficult and, in some cases, almost impossible. In addition, the aesthetic outcomes after breast conservation vary widely, and the results are often unpredictable after postoperative radiation therapy. When poor outcomes occur (**Fig. 3**), surgical intervention with salvage mastectomy is often required to alleviate painful retraction from scarring, and the options for various methods of reconstruction may be limited given the commonly seen damage to the skin and underlying tissues secondary to postlumpectomy radiation.

DEFINITION OF ONCOPLASTIC SURGERY

The issues (discussed previously) helped spark the notion for a surgical subspecialty focused on breast surgery. Ultimately, in 2000 this led to the establishment of breast fellowship training programs, and in all likelihood, this subspecialty training will soon include training in oncoplastic surgery. The term, *oncoplastic surgery*, is fitting and was coined by Dr Werner Audretsch in an attempt to describe the blending of surgical techniques from the fields of surgical oncology and plastic and reconstructive surgery. The premise is that whenever surgery is to be performed on the breast, consideration for cancer and aesthetics must be included. A handful of surgeons scattered over many countries began practicing in this manner in the early 1990s; however, only in the past decade has this approach gained widespread acceptance and enthusiasm in the United States. No doubt, this slow process of adoption was necessary in order to ensure that new techniques would not jeopardize patient safety. It is well recognized that oncoplastic surgery can improve surgical outcomes in a safe and effective manner as long as patient selection is appropriate.^{5-8,11-13} It is for this reason that multidisciplinary approach to the preoperative work-up is key to the practice of oncoplastic surgery.

Oncoplastic surgery does not refer to any given procedure; rather, it describes a surgical mindset in the approach of a patient facing various types of breast surgery. For example, a woman who presents for breast reduction surgery (commonly considered an aesthetic procedure) should be questioned about her risk for breast cancer and should undergo a preoperative work-up, including appropriate breast examination and imaging. This is done as a preoperative baseline and as a way to detect any potentially occult lesions within the breast. Any abnormalities are worked up prior to surgery, which may include mammography, ultrasound, MRI, and even minimally invasive biopsy if necessary.

Similarly, a patient presenting with a diagnosis of breast cancer in the setting of large pendulous breasts may be an ideal candidate for a large tumor resection performed using standard techniques for breast reduction. Both of these examples illustrate how the oncoplastic approach can be applied to various clinical situations. Furthermore, the utility of breast reduction as a method for resection of breast cancer offers broad applications in oncoplastic surgery (**Fig. 4**).^{10,13,14}

ONCOPLASTIC SURGERY AND BREAST CANCER

Care of breast cancer patients can vary widely depending on the clinical environment. At times, patients may experience a fragmented approach to their care, requiring them to visit multiple different physicians at various institutions. Sometimes, these clinicians

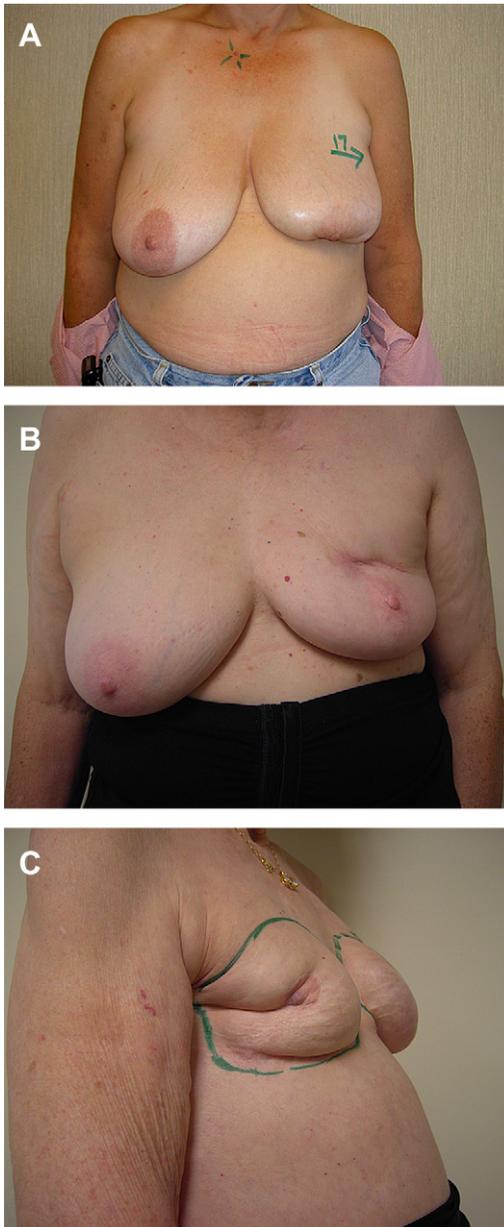


Fig. 3. These patients illustrate poor aesthetic outcomes and painful scar contractures that can occur in some cases after breast conservation surgery followed by radiation therapy. (A) Severe scar contracture following excision of tumor from inferior segment of large pendulous breast. (B) Large glandular deformity with scar contracture adherent to chest wall following lumpectomy in superior central portion of the breast. (C) Scar contracture with lateral rotation of nipple-areolar complex following lumpectomy at lateral aspect of breast.

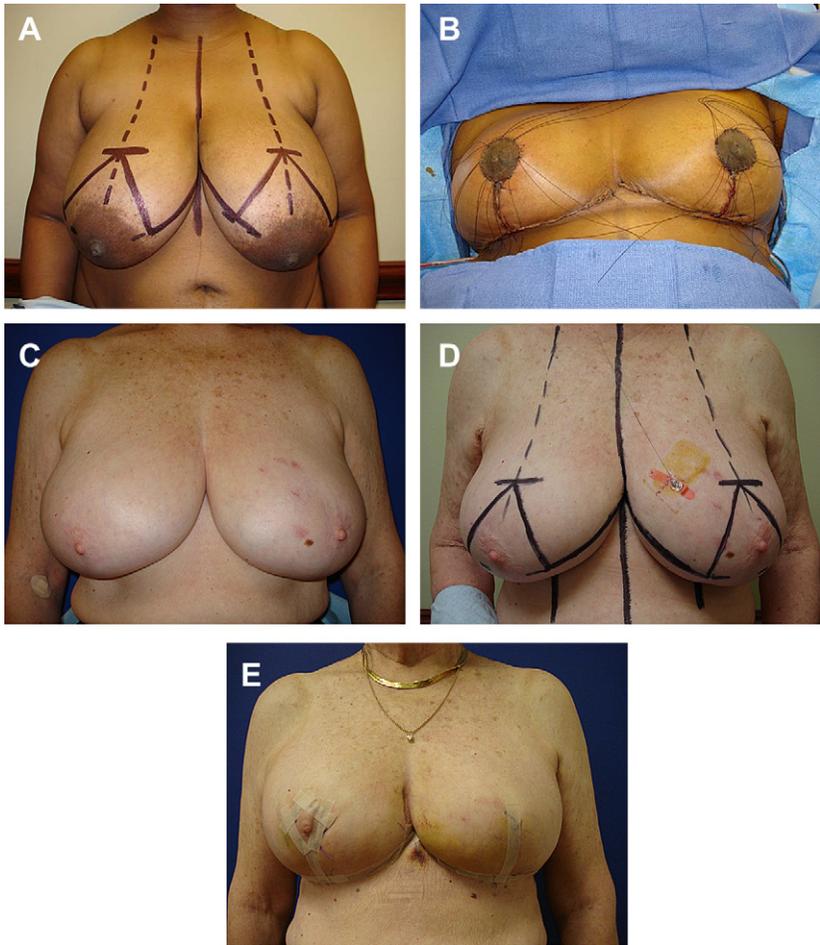


Fig. 4. (A) Preoperative photograph of a 43-year-old woman with large pendulous breast and small invasive cancer found on screening mammogram. Lesion was located in the inferior aspect of left breast. Markings illustrate skin markings standard for reduction mammoplasty techniques. (B) Immediate surgical result after breast reduction, sentinel node biopsy, and reconstruction using standard breast reduction techniques and free nipple-areolar transfers. (C) Preoperative photograph of patient with multiple central tumors in left breast. (D) Preoperative photograph showing patient with skin markings and wire-localization to confirm area of tumor. (E) Immediate postoperative photograph showing central lumpectomy technique to remove central tumors and reconstruction using standard reduction mammoplasty techniques.

may not even communicate with one another about a given patient. The multidisciplinary model has helped encourage a team approach, however, and has more commonly become an integral part of patient care in many centers. This model provides structure for comprehensive review within a multidisciplinary tumor board conference, where individual patients are reviewed by the different specialty teams providing care. This helps coordinate and optimize a plan for each patient and allows physicians and patients a more comprehensive approach.⁹

The practice of oncoplastic surgery requires that surgeons obtain a level of understanding of each of the critical components of cancer care, including those of other disciplines, in order to integrate the knowledge when devising a surgical plan. This can be accomplished in a variety of practice settings but is important particularly if surgeons are in an environment that does not have access to a multidisciplinary clinic or team. Often there is a surgical oncologist working in concert with a plastic and reconstructive surgeon. Even in this situation, it is crucial for the two surgical teams to confer prior to surgery in order to optimize the oncologic and aesthetic outcomes. In some environments, breast surgeons need to be able to integrate this knowledge independently and even perform both aspects of the surgery. Thus, the need for changes in the training curriculum for oncologic breast surgeons becomes obvious and should include the addition of aesthetic and reconstructive techniques. Currently, an international steering committee has been challenged with the task of developing standardized recommendations for training, and a preliminary outline of proposed skills for various levels of training is listed in (Table 1).

PREOPERATIVE ASSESSMENT

As discussed previously, a thorough preoperative assessment is critical when practicing oncoplastic surgery so as to insure appropriate patient selection. This evaluation begins with a comprehensive history and physical examination that pays particular attention to details that may indicate an increased risk for breast cancer or an increased risk for a recurrence. Often, patients present with a known history or recent diagnosis of breast cancer, but some may seek surgical consultation for other reasons, such as a strong family history of breast cancer. In each instance, a complete evaluation should be performed, including

- Complete personal and family medical history
- BRCA testing if indicated
- Evaluation of additional risk factors, such as hormone replacement therapy, history of radiation treatment for Hodgkin's disease, etc

Table 1 Preliminary guidelines for standardized training in oncoplastic surgery	
Level I	<p>Thorough knowledge and understanding of risk assessment within the multidisciplinary framework</p> <p>Thorough knowledge and understanding of aesthetic principles and reconstructive options</p> <p>Devise comprehensive surgical approach without compromise of oncologic or aesthetic principles</p> <p>Ability to perform large resections with breast conservation surgery</p> <p>Ability to design and implement glandular resections and use local tissue for reconstruction</p>
Level II	<p>Ability to perform skin-sparing mastectomy</p> <p>Ability to perform breast reduction with/without nipple transfer</p> <p>Ability to perform mastopexy</p>
Level III	<p>Ability to perform augmentation mammoplasty</p> <p>Ability to perform mastopexy with implants</p> <p>Ability to perform nipple-areolar-sparing mastectomy</p> <p>Ability to perform capsulectomy/implant removal and reconstruction</p> <p>Ability to perform various types of implant/expander reconstruction</p> <p>Ability to perform nipple reconstruction</p>
Level IV	<p>Specialty training to include myocutaneous flaps</p>

- General medical condition
- Smoking history
- History of previous breast surgery, biopsies, implants (including size/type), and so forth
- Multimodality breast imaging (review films: mammography, ultrasound, MRI)
- Patient desires in regards to breast shape, size, symmetry.

Particular attention to details from prior surgical procedures should be obtained and a thorough review of all previous medical records, imaging studies, and pathology (actual films and slides) should be completed.^{9,10,15}

SURGICAL PLANNING

Under the best circumstances, surgeons function as patient advocates in developing a surgical plan in order to achieve the objectives of surgical treatment. These objectives include (1) obtaining optimal local control of the tumor with wide margins free of disease; (2) prevention of local recurrence, because 80% of tumor recurrences ultimately occur at the site of the original tumor and a significant number of women may have multicentric/multifocal disease; and (3) maintaining or improving the aesthetic appearance of the breast. In addition to the preoperative assessment (discussed previously), **Table 2** provides clinical indications and rationale for the use of

Table 2 Clinical indications and rationale for preoperative MRI	
Clinical Indication	Rationale for Preoperative MRI
Newly diagnosed patients with breast cancer	Define extent of disease, multifocality, contralateral lesions, etc. Helps to refine surgical plan
Yearly follow-up for breast cancer patients including those post reconstruction	May help to identify lesions difficult to detect postoperatively by mammography/ultrasound
Cancer screening in high risk patients	Adjunct to screening mammography for women with dense breasts, BRCA positive, etc.
Evaluation of indeterminate lesions after mammography and ultrasound	When high index of clinical suspicion and lesion is not visualized with other imaging methods
Cancer screening in women with breast implants in addition to mammography	May help to identify lesions underneath or blocked by implant placement
Monitor response to neoadjuvant therapy	Helps determine length of preoperative course of chemotherapy and defines area for surgical resection
Locate primary disease in patients with axillary nodal disease and unknown primary	Adjunct to mammography and ultrasound if primary not located by these methods
Evaluation of silicone gel implants (as recommended by the Food and Drug Administration)	Can distinguish intracapsular versus extracapsular gel implant rupture
Adjunct to screening mammography in women with dense breasts	In particular, those women with dense breasts and at increased risk for breast cancer
Preoperative assessment in patients undergoing elective breast procedures	As baseline and to identify any possible occult lesions

preoperative MRI as it pertains to surgical management/follow-up. Although a standard role for MRI in breast surgery remains controversial, the use of MRI in oncoplastic surgery is essential.^{16,17}

In exploring the role of oncoplastic surgery and breast conservation, several comprehensive articles have been published describing level I (listed in **Table 1**) oncoplastic techniques for lumpectomy and reconstruction of the breast using local tissue flap advancement to minimize breast deformities.^{18,19} The most recent and thorough publication has been presented by Clough and colleagues.¹³ This monograph provides a detailed quadrant-by-quadrant atlas for oncoplastic surgery and illustrates the importance of defining the volume of tissue to be excised compared to patients' overall breast size. When contemplating the decision between breast conservation and mastectomy, it becomes imperative to consider factors, such as skin laxity, degree of ptosis (sagging), and nipple-areolar position.

Given the limitations of this brief review, a few of the creative techniques in oncoplastic surgery that offer an opportunity to improve outcomes after mastectomy are focused on. This discussion is separated into two parts, depending on patient breast size, because the surgical approaches differ completely for patients with small versus large breasts. Any and all of these procedures can be combined with other important techniques such as sentinel lymph node biopsy and wire localization.

THE SMALL BREAST

In many cases, surgeons find that patients with small breasts often choose mastectomy rather than breast conservation. These patients frequently make excellent candidates for using creative surgical techniques for mastectomy, and they tend to share some common factors. Often these patients present with an early stage of disease, but the tumor may require a relatively large excision in comparison to the volume of existing breast tissue. These patients may also present at a young age and they frequently lead active lifestyles. In addition, they may fear or truly be faced with an increased risk for cancer recurrence due to several factors, such as histologic subtype, family history of breast cancer, extended longevity, and/or other factors. Consequently, many of these patients seek mastectomy, and often they desire immediate reconstruction. In this setting, skin-sparing mastectomy with immediate implant reconstruction can be the ideal solution, and a pleasing aesthetic appearance of the breast can be achieved without compromise as shown here in **Fig. 5**, this is a staged procedure. The first stage consists of a skin-sparing mastectomy, sentinel node biopsy (axillary dissection if indicated), and first-stage breast reconstruction. The second stage achieves the nipple-areolar reconstruction and is typically performed as an outpatient procedure after completion of any necessary adjuvant therapy. Aesthetic changes, such as adjusting implant size and position, breast shape, and nipple-areolar reconstruction are achieved.

In some cases, it may be appropriate to preserve the nipple-areolar complex. This can be achieved using similar techniques and is often a viable surgical option for high-risk patients (ie, BRCA positive) prior to any evidence of disease (**Fig. 6**).

THE LARGE BREAST

Patients with large breasts afford oncoplastic surgeons more options for surgical creativity. The most important aspect of these procedures is the use of the Wise pattern for the skin incision. This technique is widely applicable and can be used for procedures such as mastectomy, partial mastectomy (removal of the inferior segment of the breast) as well as central lumpectomy. Again, use of these techniques does not

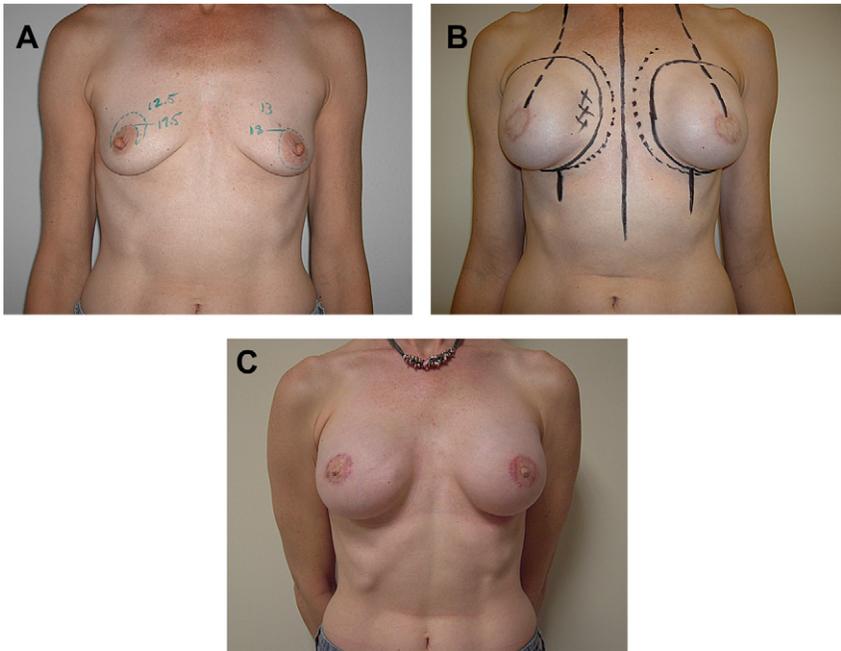


Fig. 5. (A) Preoperative photograph of patient with *ductal carcinoma in situ* right breast and positive for BRCA mutation. (B) Photograph showing same patient after bilateral skin-sparing mastectomy, first-stage immediate reconstruction with submuscular saline implants. Markings show areas for improvement in final aesthetic outcome for second-stage reconstruction. (C) Postoperative photograph of same patient after second-stage reconstruction and bilateral nipple-areolar reconstruction.

preclude the addition of wire localization, and/or sentinel node biopsy. Many of these techniques follow the standard approach to breast reduction but extend resection to include the nipple-areolar complex if involved or close to the primary tumor (central lumpectomy). These techniques can be used in a multitude of clinical situations lending excellent results for breast conservation or mastectomy with or without reconstruction. If the nipple-areolar complex is removed, it can be reconstructed at a later, second stage after adjuvant therapy is completed. If necessary, radiation therapy can

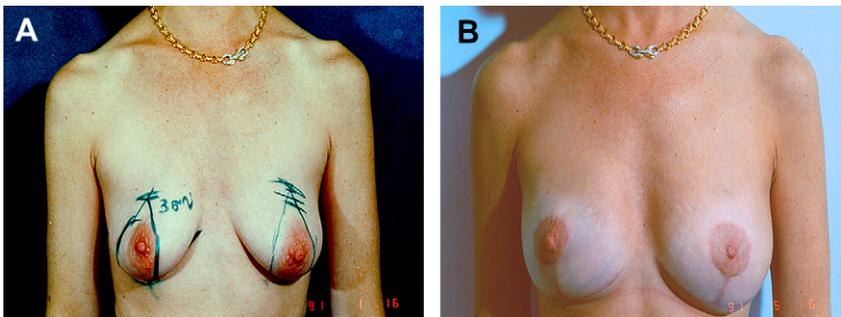


Fig. 6. (A) Preoperative photograph of patient with BRCA mutation, strong family history, and desire for bilateral prophylactic mastectomy with immediate reconstruction. (B) Postoperative photograph of same patient after bilateral mastectomy with reconstruction.

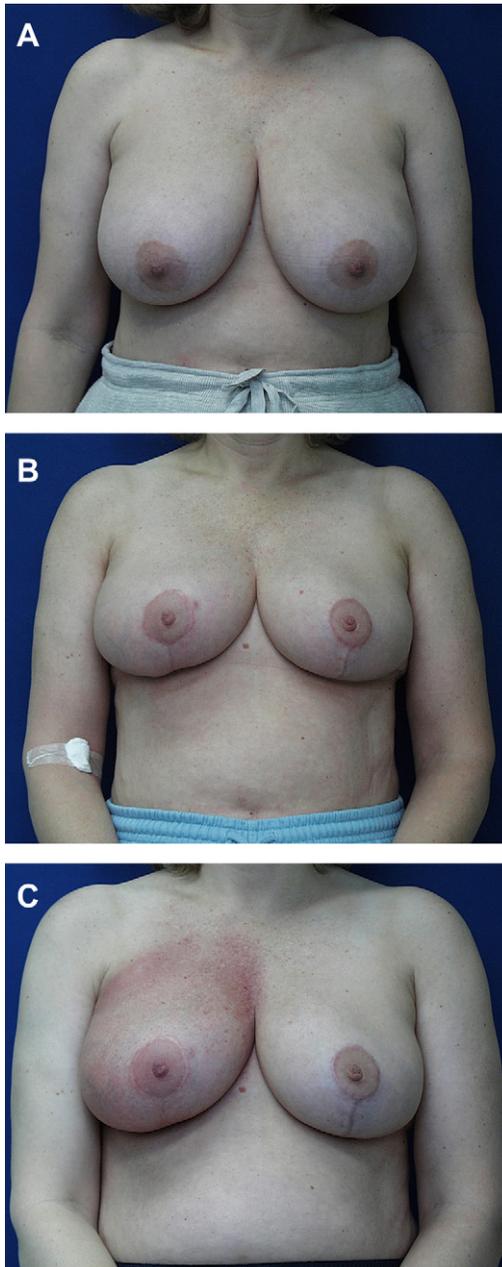


Fig. 7. (A) Preoperative photograph of patient with invasive cancer right breast and large pendulous breasts. (B) Postoperative photograph of same patient. (C) Same patient after postoperative radiation therapy illustrating skin changes. Shrinkage of the breast can occur as well.

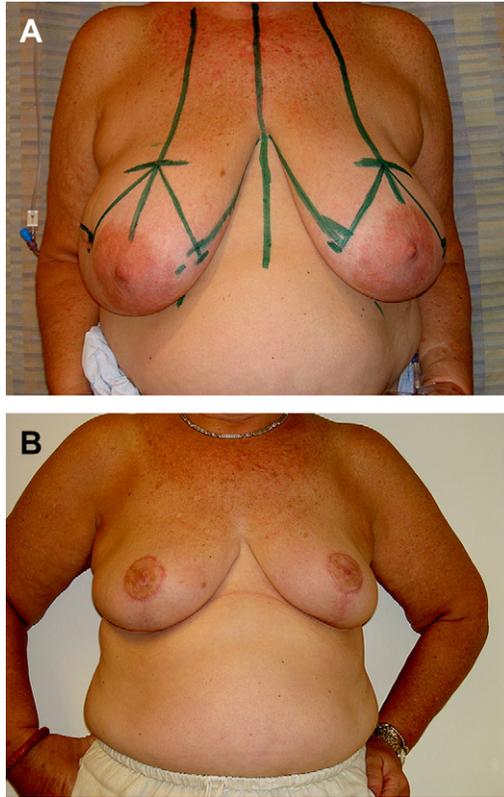


Fig. 8. (A) Preoperative photograph of patient with invasive cancer right breast located in inferior segment of the breast. Skin markings for standard reduction mammoplasty are shown. (B) Postoperative photograph of same patient after reduction mammoplasty for resection of tumor and bilateral nipple-areolar transfer.

be added after completion of postsurgical healing, and once complete, the nipple-areolar reconstruction can be performed. As with all patients undergoing breast surgery, a thorough review of the potential risks and complications should be completed, and patients should be aware of the likelihood for asymmetry, particularly if radiation therapy is administered (Fig. 7).

Because the principles of breast reduction surgery lend tremendous versatility to the breast cancer surgeons' repertoire, it is perhaps the first and most important procedure for oncoplastic surgeons to learn (Fig. 8). Once mastered, techniques such as mastopexy and skin-sparing mastectomy will follow more easily and the ability to develop comprehensive surgical approaches unique to each patient becomes second nature.

SUMMARY

In many circumstances, historical turf issues have delineated which procedures belong to a given specialty. The case for oncoplastic surgery, however, is different. The breast has long been regarded in many societies as a symbolic anatomic structure—one that embodies motherhood, femininity, and grace. Because this highly

regarded female organ is so often the unfortunate victim of cancer, surgeons must change their approach, combining academic life-saving surgical techniques with a woman's sensitivity to preserving the aesthetics of the breast, in order to be effective patient advocates in the fight against breast cancer. Therein lies the foundation for the field of oncoplastic surgery.

The cross-fertilization that occurs when specialists from different fields convene to devise a treatment plan for given patients is formidable. There is no doubt that maintaining the multidisciplinary approach is paramount to the successful outcomes in oncoplastic surgery, and the benefits include improved aesthetic results after cancer surgery. As these procedures are adopted by surgeons throughout the world (teams of surgeons working together or individual surgeons), oncoplastic surgical training combined with appropriate patient selection will ultimately lead to achieving safe and aesthetically pleasing outcomes for breast cancer patients. Hopefully with time, the practice of oncoplastic surgery will help to alleviate some of the long-standing fear and hatred associated with the surgical treatment of this disease.

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