

Oncoplastic Breast Surgery: Current Status and Best Candidates for Treatment

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Current Breast Cancer Reports 2009, 1:118-123

Current Medicine Group LLC ISSN 1946-4588

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The term *oncoplastic surgery* was coined to describe an evolving area of breast surgery that applies the principles of surgical oncology and plastic and reconstructive surgery to the management of women with breast cancer. Oncoplastic surgery does not describe a particular surgical procedure; it represents a comprehensive approach to surgical planning intended to achieve 1) widened surgical margins; 2) reduced local recurrence risk; 3) optimized cosmetic outcome; and 4) breast volume reduction when patients with macromastia develop breast cancer. This specialized field of cancer surgery, once confined to surgeons practicing in Europe, has gained popularity and attention in the United States, with surgeons anxious to achieve these goals for patients. Multiple factors have combined to allow surgeons to use innovative surgical solutions to simultaneously improve oncologic outcome and surgical cosmesis. This article explores current aspects of oncoplastic surgery, summarizes how various methods are applied in clinical practice, and discusses future directions in the emerging field of oncoplastic breast cancer surgery.

Introduction

Breast surgery has evolved over the past century, since Halsted first introduced the radical mastectomy at the turn of the 20th century [1]. Radical mastectomy was a critically important development in cancer therapy, representing the first major success in breast cancer treatment and the standard of breast cancer care until the 1970s. However, the dramatic disfigurement and emotional distress associated with this aggressive surgical technique for removing the breast, lymph nodes, and

pectoralis muscles stimulated investigation into alternate, less traumatic surgical approaches. Because of fear of potentially disastrous consequences related to inadequate treatment, the scientific community appropriately demanded proof that less aggressive surgery would not harm patients faced with a breast cancer diagnosis. Randomized clinical trials showed that the modified radical (muscle-preserving) mastectomy is equivalent to radical mastectomy in outcome, creating a new pathway for scientific investigation to improve oncologic outcome and decrease morbidity in the setting of surgical therapy for women with breast cancer [2].

In the past 30 years, a series of critical clinical trials have proved that less aggressive surgical resection of the breast does not in fact endanger patient lives. Both the Milan trials and the National Surgical Adjuvant Breast and Bowel Project breast conservation studies, which started in the 1970s and gained widespread notoriety in the mid-1980s, have now published long-term results with at least 20 years of follow-up. These results support the original hypothesis that breast conservation treatment is equivalent to mastectomy as measured by overall survival [3,4]. Other trials are now well understood and accepted that prove the importance of combining surgery with adjuvant radiation therapy to lower local-regional recurrence and systemic adjuvant treatment to reduce distant metastatic disease and improve survival.

Through these many studies, a methodological approach was developed to improve multidisciplinary cancer therapy to evaluate, treat, and study women with breast cancer. This scientific approach has become an accepted cornerstone for obtaining optimal patient outcomes and is similarly relevant to the introduction of new oncoplastic surgical techniques [5]. A recent study has demonstrated that oncoplastic approaches add to the oncologic safety of breast-conserving treatment, because a larger volume of breast tissue can be excised and more widely negative surgical margins can be obtained [6]. Oncoplastic techniques are especially indicated for large tumors, for which standard breast-conserving approaches have a high probability of leaving positive margins associated with heightened local recurrence risk and/or creating unacceptable deformity of the breast [7,8].

Table 1. Preoperative clinical assessment

Comprehensive history and physical examination (eg, including review of current and past examinations, surgeries)
Preoperative laboratory evaluation (including selected blood tests, electrocardiogram, chest radiograph, bone scan)
Genetic testing (when applicable)
Diagnostic mammography (with minimally invasive biopsy as indicated)
Diagnostic breast ultrasound as needed (with minimally invasive biopsy as indicated)
Consider bilateral preoperative breast MRI on newly diagnosed cancer patients. In addition, refer to indications for breast MRI as outlined by American Cancer Society and American College of Radiology
Aesthetic evaluation of the breasts and patients' concerns/desires for possible change, preoperative photography
Consideration of various reconstructive options
Surgical planning including extent of resection and skin sparing, with consideration for timing of adjuvant therapies such as chemotherapy and radiation

Preoperative Evaluation

Patient selection

The question “Who is a good candidate for oncoplastic surgery?” is to a certain degree erroneous, because integration of surgical oncology with plastic and reconstructive surgery principles can be applied to all patients. Because the term *oncoplastic surgery* does not refer to a given surgical procedure but rather defines a general approach to surgical decision making and execution, using these same tools helps identify types of procedures or techniques that would best apply to any breast surgery patient [9]. This is applicable not only to breast surgery, but also to other surgical disciplines in which cosmesis is relevant, such as dermatologic surgery.

Outside record review

We strongly recommend the gathering of as much medical information as possible on each and every patient before devising a surgical approach to cancer resection (Table 1). The preoperative review of patient history deserves special attention, because numerous patient scenarios can arise in different clinical practice environments. This historical survey should be comprehensive in nature, including a gathering and review of all relevant medical information. In many cases, records will need to be obtained from outside sources. Old medical records may provide critical missing information, especially when patients are uncertain about the details of prior interventions. Outside imaging studies and pathology slides (not just their reports) should be reviewed to confirm that the outside findings and interpretations can be corroborated by the treating clinical team. Many institutions are adopting new rules requiring that imaging studies and pathology slides be reviewed internally to verify that subsequent interventional procedures are definitely indicated.

Special attention should be given to those patients who have undergone previous breast surgeries, including diagnostic procedures, previous cancer surgery (with or without radiation therapy) and/or cosmetic breast surgeries. Both augmentation and breast reduction surgery can directly impact the surgical outcome of various types of

oncoplastic resections. Because the location of previous incisions can affect the skin's blood supply and viability with subsequent operation, it is imperative for the breast surgeon to become familiar with and understand previous surgeries that have been performed, particularly if a skin-sparing mastectomy is being contemplated.

In patients who currently have or previously had breast implants, it is essential to know the placement of the implant (prepectoral vs subpectoral) and the exact type and size of the implant (if an implant is still in place). Prior operative reports can be helpful when the implants have been surgically removed, because these documents delineate whether the tissue capsule around the implant was excised at the time of implant removal. This knowledge can be important for avoiding diagnostic dilemmas during the breast-imaging work-up and physical examination, as remnants of the old tissue capsule, may look and feel very much like abnormal (ie, malignant) changes in the breast.

Comprehensive history and physical examination

A comprehensive history includes present and past medical history, reproductive history, and assessment of cancer risk factors including family history, use of hormone replacement therapy or birth control pills, and history of chemical exposure or prior radiation treatment [10]. Special attention is given to general health issues that may affect the specific type or degree of surgery that can be safely performed, and to the patient's desires with regard to the aesthetic outcome to be achieved. In some instances, surgical intervention may be bilateral to achieve breast symmetry, so a thorough discussion with the patient should include a discussion of the patients' desires with regard to breast size and shape. Additional surgical procedures, such as breast reduction, augmentation, and mastopexy, can be performed at the same surgery when these procedures can be integrated appropriately with the oncologic surgical intervention [11].

Multimodality breast imaging

Screening mammography, which has been increasingly used in the United States since the early 1980s, has significantly increased the number of women diagnosed with

early (stage 0, I, or II) breast cancer. Breast cancer mortality, which was essentially unchanged from the 1930s through the 1980s, has decreased every year since 1991, which at least in part relates to improved early detection of disease [12]. Additional breast imaging techniques, including breast ultrasound and MRI, have helped clinicians more clearly define the extent of disease, facilitating surgical planning for breast conservation therapy [13•], and in the case of MRI, may also help to detect mammographically occult cancers in the contralateral breast [14].

The combined use of sophisticated breast imaging (mammography, ultrasound, and MRI) with minimally invasive biopsy techniques has definitely assisted us in the evolution and adoption of oncoplastic surgery. By thorough preoperative investigation, surgeons are better able to more fully understand the extent of existing disease, and also to assess if the patient is at higher risk for recurrence if breast conservation is used. Complex imaging helps estimate tumor size and location in relation to the overlying skin, nipple-areolar complex, underlying muscle, and/or other adjacent structures, such as implants. In this manner, surgeons have applied creative approaches to excise larger regions of the breast while preserving overall shape and appearance.

Although diagnostic imaging clarifies the extent of disease, it also demonstrates findings that require additional work-up and tissue sampling. Complete breast imaging can guide the surgeon and patient to make the most thorough assessment, but additional biopsies are often necessary to rule out disease that is extensive or multicentric. A significant fraction of these image-detected areas will prove to be benign false-positive findings, making indispensable the use of minimally invasive/image-guided biopsies. In well-integrated breast practices, the surgeon and radiologist can review images and histologic findings together, thereby allowing the surgeon the opportunity to define multiple treatment options for the patient before taking her to the operating room. In this manner, using the multidisciplinary approach in evaluating patients for oncoplastic breast surgery helps devise comprehensive surgical plans.

Multidisciplinary communication and collaboration

In many clinical practices, patients are evaluated by separate teams (eg, surgical oncology, radiology, plastic and reconstructive surgery, medical oncology). The multidisciplinary “tumor board” provides these teams the opportunity to review cases and compare notes, thereby optimizing the delineation of therapeutic options [15•]. In clinical settings in which various members of the team fail to communicate with each other, patients may not become fully informed about available choices. Oncoplastic surgical planning is best achieved in a multidisciplinary fashion, with consideration given to complete cancer risk assessment and full treatment planning (including the consideration for the aesthetic desires of the patient) before surgery. Multidisciplinary communication can be

achieved in a number of settings, even if a single physician (such as the surgeon) ultimately guides the patient through an understanding of the treatment options and plan. The main point remains that a broader, more comprehensive preoperative work-up is essential.

Surgical Decision Making

Breast conservation versus mastectomy

Without a doubt, successful transition from mastectomy to breast conservation therapy has irreversibly changed breast cancer management. With modern early-detection strategies, most breast cancer patients diagnosed in the United States are also breast conservation candidates. However, not all women are good breast conservation candidates due to extent of disease, and not all women will have a good cosmetic outcome following breast conservation surgery when it is followed by radiation treatment. The assumption that all women prefer breast conservation therapy to mastectomy is not always correct. Many women express that they would prefer to minimize risk of local recurrence even if it means losing their breast. For others, the practical difficulties associated with postlumpectomy radiation therapy lead some to choose mastectomy as the operation of choice. Each and all of these factors must be considered before surgery, as the surgical plan (type and placement of incision, region of breast tissue to be excised, approach to mastopexy closure) may differ if the option for mastectomy with reconstruction offers a better overall outcome. Surgical judgment is critical to the assessment of whether breast conservation yields an adequate margin without leaving an excessively large deformity.

Surgical Planning

Oncoplastic surgery: combining principles and procedures

Once the preoperative assessment is complete and the surgeon and the patient agree on whether breast conservation or mastectomy is preferred, the surgical planning begins. In many cases, this will entail a discussion of whether reduction, lift, or augmentation on the opposite breast may be necessary to achieve breast symmetry. Various oncoplastic techniques for breast conservation surgery have been described (Table 2). Some of these procedures are more complicated than others and may require the breast surgeon to complete advanced training or, depending on the clinical setting, may require a team approach with a plastic and reconstructive surgeon. Although anatomic and surgical planning of specific procedures is beyond the scope of this review article, the literature is beginning to describe more and more useful details for the surgeon integrating oncoplastic surgery into practice [16•,17,18].

The general approach to surgical planning considers the breast in a new light and looks at various anatomic aspects separately. For example, the glandular elements

Table 2. Oncoplastic techniques and their applications

Oncoplastic technique	Breast conservation	Mastectomy
Radial segmental resection (quadrantectomy)	Yes	–
“Batwing” resection	Yes	–
Benelli (“donut”) mastopexy	Yes	–
Classic (“Pitanguy”) mastopexy including vertical mastopexy	Yes	–
Augmentation (implant placement, replacement)	Yes	–
Superior pedicle reduction mammoplasty	Yes	Yes
Nipple-areolar reconstruction	Yes	Yes
Breast reconstruction (implants, expanders, myocutaneous flaps)	–	Yes

of the breast containing the area of disease are assessed for resection separately from the overlying skin and the nipple-areolar complex. In some cases, skin resection can greatly facilitate wide excision of the underlying diseased fibroglandular tissue. In others, skin overlying the affected area may safely be spared. The literature clearly supports preservation of the skin envelope in appropriate cases, whereas in some cases subcutaneous mastectomy and/or nipple-areolar sparing may be applicable [19]. These techniques are most easily applied for early stage, favorable histologic subtypes so as not to compromise the patient’s oncologic outcome. Knowing that survival rates are equivalent with breast conservation, it obviously should then follow that skin-sparing mastectomy would likewise yield at least the same outcome.

Reduction mammoplasty as a tool for breast-conserving surgery or mastectomy

The reduction mammoplasty procedure may have the broadest application in oncoplastic surgery. The reduction mammoplasty can be adapted for breast conservation, achieving extremely large resections of tissue with or without removal of the nipple and areola, and can be combined with any type of contralateral reconstructive technique. Using a superior pedicled pattern, surgeons can resect tumors along the entire inferior aspect of the breast, central and retro-areolar area, lateral, and upper outer quadrants. The reduction mammoplasty incision can also be used with total mastectomy in conjunction with immediate reconstruction and will yield a much better appearance of the chest wall by eliminating the excess skin or “dog ear” at the lateral aspect of the chest wall. When the surgeon learns to adapt this technique to breast cancer resection, the same approach can also be used to achieve symmetry of the opposite breast (Fig. 1).

Adjunctive procedures

Primary consideration is given to adjunctive surgical procedures that may be needed, and these must be incorporated into the surgical planning. Such procedures include wire localization of nonpalpable lesions, ultrasound-guided resection of tumor, and sentinel lymph node biopsy. Oncoplastic surgery should not preclude or interfere with the surgeon’s use of these important techniques.

Breast reconstruction

Breast reconstruction has undergone dramatic development in parallel to the above listed advancements in the other disciplines treating breast cancer. With the advent and integration of breast implants and expanders and with the improvements in myocutaneous flap reconstructions, the field of breast reconstruction has achieved great success. However, recent studies reveal that most women undergoing mastectomy (as many as 80%) are not having breast reconstruction. This is a disturbing statistic, and can be attributed to many factors. Unfortunately, the outcome is that fewer and fewer surgeons are committed to this highly specialized area leaving far too many women with no option for reconstruction.

This is perhaps the area in which oncoplastic surgery can really help the future of breast surgeons. Although each surgeon may not take on the responsibility of performing breast reconstruction, an intimate knowledge of the various techniques, the risks, benefits, and timing of each type of reconstruction can help the patient and surgeon when planning the primary surgical approach, as this allows for integration of all aspects of the surgery. In those areas where a surgeon is not available to perform reconstruction, it will serve the breast surgeon and their patients to learn at least some type of reconstructive surgery. In many cases, immediate breast reconstruction can at least be started at the time of mastectomy with placement of an implant, expander, or flap. This ultimately helps the patient emotionally through the loss of the breast, and in most cases, decreases the number of surgical procedures the patient ultimately needs to undergo.

Oncologic Safety

Oncoplastic partial mastectomy techniques are becoming increasingly recognized and accepted. These procedures allow the removal of larger cancers that otherwise would require mastectomy with improved cosmetic outcome. The concern of removing larger cancers with breast conservation techniques that could translate into heightened local recurrence risk appears to be offset by the apparent widening of surgical margins by virtue of designing resections that follow the segmentally distributed contour of cancers



Figure 1. Three oncoplastic surgery cases in women with large breasts before (*left*) and after (*right*) surgery including lumpectomy in a large-breasted woman (*top*); central lumpectomy using reduction mammoplasty techniques (*middle*); and skin-sparing mastectomy combined with immediate reconstruction in a large-breasted patient (*bottom*). These cases illustrate the excellent cosmetic outcomes that can be achieved by combining various techniques to meet the needs of patients with regard to cancer resection, adjuvant therapy, and aesthetics, including symmetry with the opposite breast.

using full-thickness resection techniques. It is important to note that long-term (5–10 y) local recurrence rates have not been evaluated in large surgical series, suggesting that surgeons using oncoplastic techniques should be careful and meticulous, especially in relation to paying close attention to complete excision based on imaging findings and surgical margins on pathology. When larger resections using volume displacement techniques are performed, the radiation oncologist should be informed so that the radiation techniques can be adjusted appropriately, especially in the application of boost doses that need to target the actual tumor bed and not just where there is evidence of surgical dissection in the breast.

Conclusions

Currently, there is no formal academic training program for oncoplastic surgery in the United States. However, each year, more advanced training programs are offered for surgeons both nationally and internationally as interest in oncoplastic surgery increases [9,20,21]. Furthermore, several textbooks and a new video textbook are available

as learning tools. We predict that in the future, oncoplastic surgical techniques will become essential to the basic practice of versatile breast cancer surgeons.

Disclosure

Dr. Lebovic is a consultant for Viva Ray Medical and Neomatrix.

No further conflicts of interest relevant to this article were reported.

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