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ORIGINAL ARTICLE

Oncoplastic Techniques in the Conservative Surgical Treatment of Breast Cancer: An Overview

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■ **Abstract:** Conservative surgery has become a well-established alternative to mastectomy in the treatment of breast cancer. However, in case of larger lesions or small-size breasts, the removal of adequate volumes of breast tissue to achieve tumor-free margins and reduce the risk of local relapse may compromise the cosmetic outcome, causing unpleasant results. In order to address this issue, new surgical techniques, so-called oncoplastic techniques, have been introduced in recent years to optimize the efficacy of conservative surgery both in terms of local control and cosmetic results. This article discusses the indications, advantages, and limitations of these techniques and their results in terms of local recurrence and overall survival. ■

Key Words: breast cancer, conservative surgery, oncoplastic techniques

The surgical treatment of breast cancer has undergone continuous and profound changes over the last three decades. The long-term results of several randomized studies conducted in Europe and North America have definitively confirmed that breast-conserving surgery (BCS) and radical mastectomy yield similar rates of survival, thus endorsing BCS as the gold standard of therapy for most women with breast cancer (1,2).

The long-term success of BCS can be measured by two end points: the rate of local control and the cosmetic appearance of the preserved breast. When performing BCS, it may occasionally be difficult for the surgeon to adequately meet both of these end points, particularly when attempting to resect larger lesions or in case of small breasts.

The magnitude of parenchymal and cutaneous excision is directly correlated to the cosmetic outcome: when larger volumes of tissue are removed, the risk of an unpleasant cosmetic result increases. Olivotto et al. (3) and Mills et al. (4) have documented that excision of a volume of parenchyma greater than 70 cm^3 in medium-size breasts often leads to unsatisfactory aesthetic results. De la Rochefordiere et al. (5) and Taylor et al. (6) have documented a decline in the cosmetic scores of patients who had a volume of tissue excised greater than 86 cm^3 and 100 cm^3, respectively. Cochrane et al. (7) showed that the cosmetic outcome deteriorates when the specimen weight:breast volume ratio is greater than 10%.

This unfavorable correlation explains why some surgeons have favored more limited resections, such as lumpectomy or tumorectomy (excision of the primary tumor with margins of normal breast tissue less than 1 cm) as opposed to the classical quadrantectomy proposed by Veronesi et al. (8) ("a large resection of the quadrant harboring the primary carcinoma with at least 2 cm of normal tissue surrounding the tumor and including the removal en bloc of a large portion of overlying skin and the underlying fascia of the major pectoralis muscle").

The magnitude of parenchymal excision is also directly correlated to the rate of local control of the cancer. Therefore, with the use of more limited resections, a higher risk of local recurrence should be expected. Many studies have indeed confirmed this hypothesis. In phase II of the Milan trial, for example, 705 patients with tumors up to 2.5 cm in diameter were randomized to receive tumorectomy (excision close to the tumor) or quadrantectomy (excision of the tumors with macroscopically clear margins of 2 cm) including the skin and pectoralis fascia. Even though the overall survival rate was not different in the two groups, the rate of local recurrence at 5 years was much higher in

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the tumorectomy group (7.0% versus 2.2%). Holland et al. (9) showed that the risk of leaving cancer cells in the operated breast was inversely related to the extent of normal breast tissue removal around the tumor: with 1 cm of normal tissue resected, the probability of residual cancer foci was about 59%, while with 3 cm removed, it decreased to 17%.

Improvements in diagnostic technology and mammographic screening as well as increased use of preoperative local or systemic therapies have extended the indications for BCS to 70–80% of breast cancer patients. However, the average national rates of BCS remain below 50% in the United States (10) and 58% in Italy (11). Among the factors that can explain this underutilization of BCS are patient and surgeon concern for local recurrence or unpleasant cosmetic outcome as well as technical challenges to achieve both endpoints.

In an attempt to optimize the balance between the risk of local recurrence and the cosmetic outcomes in BCS, new surgical procedures that combine the principles of surgical oncology and plastic surgery have been introduced in recent years (12–15). These new techniques, called "oncoplastic" techniques, may allow removal of larger amounts of breast tissue with safer margins without compromising the cosmetic outcome. Oncoplastic procedures are less technically demanding and time consuming than major reconstructive operations and usually require limited training to be properly performed by surgeons experienced in routine breast surgery. These procedures are usually performed in a single surgical access, and the patient leaves the operating room without major residual asymmetry or deformity.

When designing an oncoplastic procedure, the following steps should be followed: careful planning of the skin incisions and parenchymal excisions, adequate reshaping of the gland after parenchymal excisions, repositioning of the nipple-areola complex (NAC) to the center of the breast mound, and correction of the contralateral breast for better symmetry. Depending on the location of the tumor within the breast, different oncoplastic techniques can be used (16,17).

QUADRANTECTOMY WITH ROUND BLOCK TECHNIQUE

This oncoplastic technique has its best application in the treatment of periareolar lesions, particularly in breasts with moderate ptosis or hypertrophy. Very large and ptotic breasts or breasts that are essentially fat or have a lot of additional skin represent a relative contraindication to the use of this technique. In this operation, circles of two different diameters are designed around the nipple. The skin between the two circles is resected (Fig. 1a). This incision allows comfortable access to the entire periareolar region through a wider incision when compared with traditional conservative techniques (Fig. 1b). Quadrant resection of the breast parenchyma is then performed, extending the dissection to include the pectoralis fascia and at least 2 cm of macroscopic clear margins on all sides. Reshaping of the breast is achieved by partially dissecting the residual gland off the pectoralis major muscle with the use of electrocautery. Care should be taken to avoid or limit the dissection of major vascular perforators between the pectoralis muscle and the preserved breast to minimize the risk of ischemic injury to the residual glandular tissue.

The larger circle is reduced in diameter using a purse-string suture and is then sutured to the new border of the areola. Axillary dissection is usually performed through a separate incision, but occasionally can be conducted through the same periareolar incision (Fig. 1c). If the two circles are concentric, the nipple is not elevated. If the outer circle is centered around a point superior to the existing nipple, the nipple can be slightly elevated as a consequence of the procedure. With regard to the diameter of the inner and outer circles, the latter should not exceed that of the existing areola diameter by more than 20–25 mm in order to prevent widening of the circumareolar scar or excessive flattening of the breast.

CENTRAL QUADRANTECTOMY WITH A SKIN-GLANDULAR FLAP

This oncoplastic technique is used in subareolar breast cancer and in Paget's disease. These tumors have often been excluded from BCS and treated with mastectomy because of the unacceptable cosmetic result associated with resection of the NAC, as well as oncologic concerns about multicentricity or multifocality associated with these tumors. This simple oncoplastic technique allows conservative treatment of retroareolar tumors, with excellent oncologic and aesthetic results (Fig. 2a). At first, the entire NAC is resected with the underlying cancer and the corresponding cylinder of parenchyma down to the pectoralis fascia. Creation of a new areola is achieved by means of a skin-glandular flap mobilized from the inferior lateral pole of the residual gland. The flap is deepithelialized, except for a circular area of skin close to the defect. The flap is then incised medially down to the pectoralis fascia. It is very important to appropriately separate the flap from the fascia to allow for better rotation and

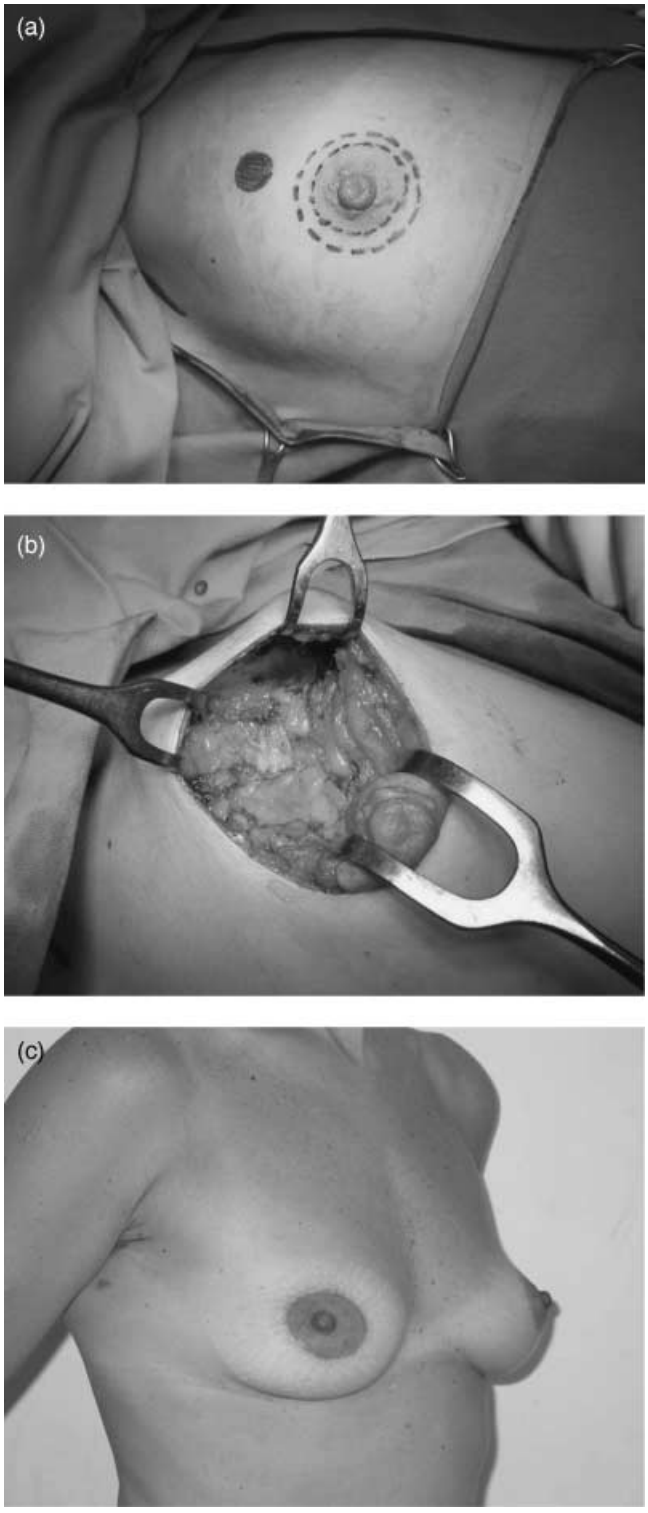

Figure 1. (a) Quadrantectomy with the round block technique begins with two concentric incisions. (b) This technique allows comfortable access to the entire periareolar region through a wide incision. (c) Final result following contralateral mastopexy to improve symmetry.

Figure 2. (a) Central quadrantectomy for cancer located under the areola. (b) Final result at 6 months after central quadrantectomy with a skin-glandular flap.

advancement. The flap is then sutured to the gland stump superiorly in order to give adequate projection to the tip of the breast mound and the circular area of spared skin is sutured to replace the excised areola (Fig. 2b). The breast may be a little smaller than the opposite one, but the shape will be pleasant. If desired by the patient, nipple reconstruction can be performed at a later stage. Care should be taken in vascularization of the skin-glandular flap to minimize the risk of ischemic injury.

QUADRANTECTOMY WITH REDUCTION MASTOPLASTY

This oncoplastic technique can be used for cancers located in the lower quadrants or in the superior periareolar region and are particularly indicated in patients with macromastia. A reduction mastoplasty keyhole pattern

incision is used (Fig. 3a). As much skin around the areola is deepithelialized as needed to shift the NAC upward to its new position (Fig. 3b–c). Skin overlying the lesion is included in the parenchymal excision, conducted down to the fascia of the pectoralis major muscle (Fig. 4a). Depending on the location of the lesion, if in the lower or upper quadrants, the flap to mobilize the NAC is created using a superior or inferior pedicle, respectively (Fig. 3b). For cancers located in the upper quadrants, the keyhole encompasses the site of the cancer and the new site of the areola corresponds to the site of the excision; the deepithelialized inferior-pedicled flap carrying the areola is advanced superiorly to fill the defect and sutured there (Fig. 4b).

For cancers located in the inferolateral or inferomedial quadrants, the keyhole pattern can be rotated slightly to allow a more lateral or medial excision, and the NAC is moved in a direction opposite to that of the surgical defect. The medial and lateral flaps are undermined and sutured together to fill the excision defect, leaving a typical inverted-T scar. With the use of a reduction mastoplasty technique, the quadrantectomy can easily remove the cancer with wide macroscopically clear margins, even in small breasts, avoiding major cosmetic defects (Fig. 3c). These techniques can also facilitate the delivery of postoperative radiotherapy, particularly in women with macromastia (Fig. 4). Consistent positioning may be quite difficult in patients with large, semifluid, or flaccid breasts, resulting in dosing inhomogeneity, a higher percentage of unacceptable late-radiation reactions (36%), and overall inadequate treatment to the breast with areas of over- and underdosing. By reducing the size of the breast, mastoplasty significantly reduces these risks without negatively affecting adjuvant therapies or clinical and radiologic follow-up (18,19).

Figure 3. (a) Cancer located in the lower quadrants is resected through a keyhole pattern reduction mastoplasty. (b) Wide parenchymal excision, including the pectoralis major fascia. (c) Final result 4 months after quadrantectomy with superior pedicle reduction mastoplasty.

QUADRANTECTOMY WITH BATWING MASTOPEXY

"Batwing" mastopexy can be considered for cancers located deep within or adjacent to the NAC, but not directly infiltrating the major ducts. Two closely similar half-circle incisions are made with angled wings to each side of the areola. Full-thickness excision is undertaken and the fibroglandular tissue is advanced to close the subsequent defect. By allowing ample removal of the skin overlying the lesion, this procedure can improve local control of cancers located superficially.

Anderson et al. (16) report that the viability of the areola is generally not at risk with batwing mastopexy: the blood supply of the external nipple arises from underlying fibroglandular tissue using major lactiferous sinuses rather

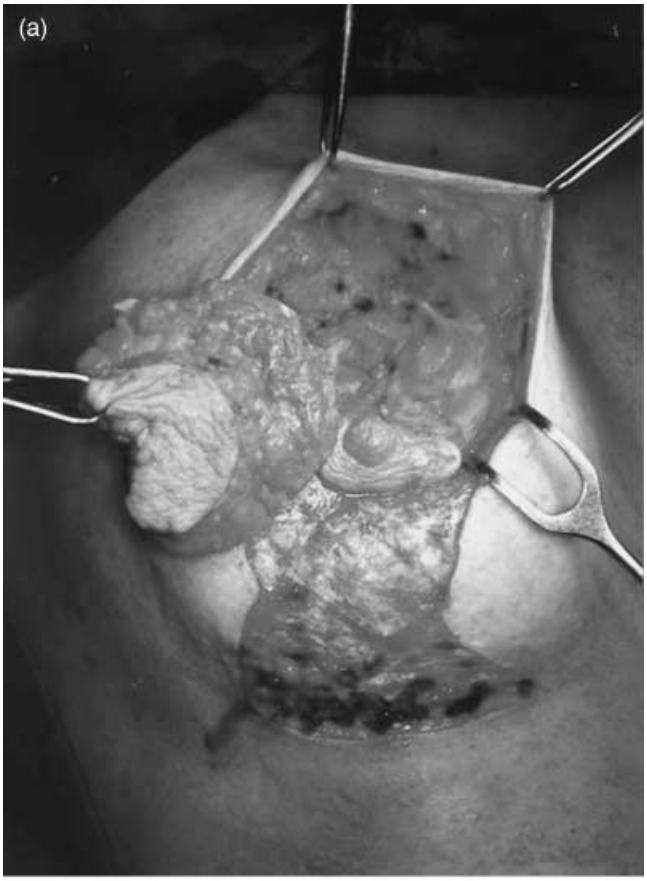

Figure 4. (a) Cancer located in the upper portion of the periareolar region. Wide parenchymal excision, including the pectoralis major fascia, is achieved through skin incisions following the template of a reduction mammoplasty. (b) Final result at 6 months after quadrantectomy with inferior pedicle reduction mastoplasty.

than the collateral circulation from surrounding areolar skin. Thus nipple necrosis could take place if dissection extends high up behind the nipple. In cases where the NAC is found to be histologically associated with cancer, the approach can be revised to a central lumpectomy (16). Patients with pendulous breasts are particularly eligible for this procedure, which can also be applied to the contralateral breast to achieve symmetry.

COSMETIC IMPROVEMENTS

In order to improve the cosmetic outcome, repositioning of the NAC or reduction or reshaping of the contralateral breast may be considered, particularly in breasts with severe ptosis. Repositioning of the NAC can prove particularly useful for large cancers located in the upper outer quadrant of the breast when extensive parenchymal excisions have been performed that can cause a dislocation of the NAC toward the axilla. Mobilization of the NAC on a dermoglandular flap and deepithelialization of a semicircular area of skin on the inferior medial side of the areola can allow a shift in the NAC to the appropriate position (Fig. 5).

Mastopexy or volume reduction of the contralateral breast may also be planned to improve symmetry and cosmetic outcome, particularly in breasts with severe ptosis. With a well-trained surgical team, the operation can be conducted on both sides at the same time, thus reducing surgery and anesthesiology times for the patient. The excision of variable amounts of tissue from the contralateral breast for symmetrization in women with breast cancer has resulted in a 5% detection rate of contralateral subclinical cancers (20).

When performing symmetrization procedures on the contralateral breast, the surgeon should use this opportunity to remove any suspicious tissue that may have been revealed by a preoperative mammogram. Oncoplastic techniques extend the indications for BCS to even larger tumors that have failed to respond to preoperative treatments or to tumors at high risk for a poor aesthetic result because of their location within the breast (retroareolar region, inner or lower quadrants).

In centers where oncoplastic procedures are widely used, the rates of BCS are as high as 85% of all breast tumors (21). Since oncoplastic techniques have been introduced only recently, there are very few data available measuring outcomes.

In one major prospective study assessing oncologic and cosmetic outcomes after oncoplastic techniques, Clough et al. (22) collected data from 101 patients with breast cancer with a median size of 32 mm. The most used surgical procedure was reduction mammoplasty with the keyhole pattern incision (83% of cases). The average weight of the resected specimen after oncoplastic procedures

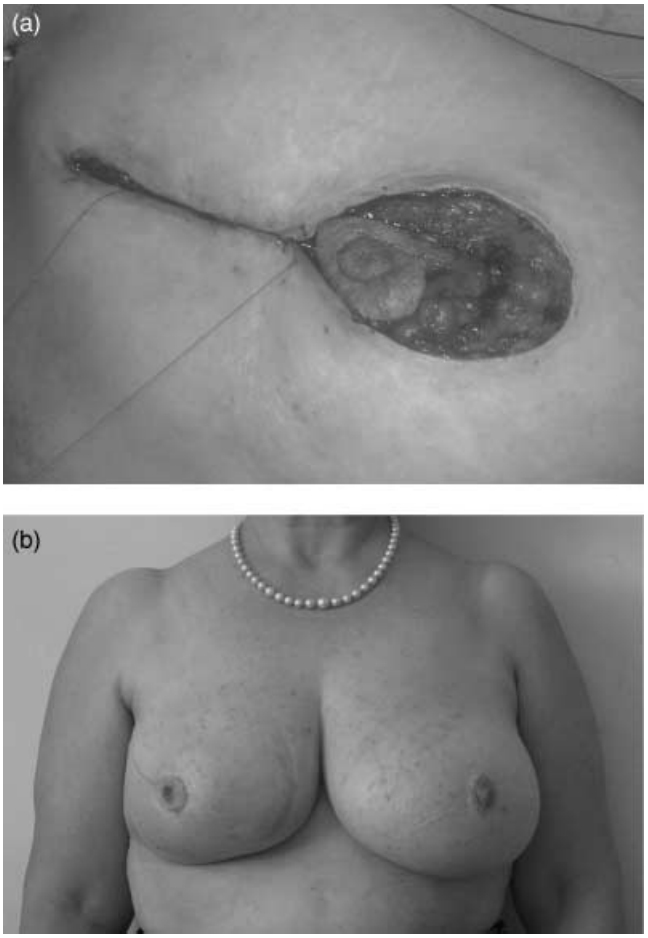

Figure 5. (a) Repositioning of the areola in a more favorable position is performed using a dermoglandular flap for transportation. (b) A semicircular area of skin inferomedial to the areola opposite to the excision is deepithelialized and the areola is sutured in the new position, maintaining it at the tip of the breast mound.

was significantly higher (220 g) compared with the average weight of a lumpectomy specimen at the same institution (40 g). After a median follow-up of 3.8 years, the rate of complications following oncoplastic surgery (fat necrosis, fibrosis, and hypertrophic scarring) was 10% and the cosmetic outcome was acceptable (excellent, good, or fair) in 88% of cases. The actuarial 5 year local recurrence rate was 9.4% and the overall survival rate was 82.8%, which compares favorably with the majority of studies of breast-conserving procedures (22).

In a recent study, 30 consecutive breast cancer patients undergoing oncoplastic procedures (group 1) and 30 patients undergoing traditional quadrantectomy (group 2) were prospectively studied with regard to cancer stage, surgical procedures, the volume of breast tissue excised, and the histopathology of the tumors, with specific details on surgical margins. Patients in group 1 were younger than patients who had a classic quadrantectomy. The oncoplastic approaches allowed larger resections, with a mean volume of the specimen of 200 cm^3 compared with 117 cm^3 in the quadrantectomy group. Surgical margins were negative in 25 out of 30 cases (83%) in group 1 and 17 out of 30 cases (56%) in group 2; the average length of the surgical margin was 8.5 mm in group 1 and 6.5 mm in group 2, even if the difference was not statistically significant (23).

Since these preliminary reports seem to indicate that oncoplastic techniques can optimize the oncologic and cosmetic results of BCS, surgeons with a special interest in breast cancer should seek proper training in oncoplastic techniques in order to be able to offer these procedures to their patients.

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