Conservative and radical oncoplastic approaches in the surgical treatment of breast cancer


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Abstract. – In the attempt to optimise the balance between the risk of local recurrence and the cosmetic outcomes in breast surgery, new surgical procedures, so-called oncoplastic techniques, have been introduced in recent years. The term oncoplastic surgery refers to surgery on the basis of oncological principles during which the techniques of plastic surgery are used, mostly for reconstructive and cosmetic reasons. The advantage of the oncoplastic surgery for breast cancer is the possibility of performing a wider excision of the tumour with a good cosmetic result. Oncoplastic surgery is a broad concept that can be used for several different combinations of oncosurgical and plastic surgery: excision of the tumour by reduction mammoplasty, tumour excision followed by remodelling mammoplasty, mastectomy with immediate reconstruction of the breast and partial mastectomy with reconstruction. Careful patient selection and preoperative planning are key components for the success of any oncoplastic operation for breast cancer. Accurate preoperative evaluation of the clinical and biological features of the tumor as well as of the morphological aspects of the breast allow the surgeon to make a decision if a radical or conservative approach is preferable and select the most effective surgical technique. Available options are discussed with the patient, highlighting the advantages and disadvantages of each procedure and the technical challenges.

When no major obstacle exists in achieving optimal local control and good cosmetic results with preservation of the breast, the treatment of choice is breast-conserving surgery1-3. Total mastectomy is considered mandatory only for multicentric disease, T4 and inflammatory tumors, extensive malignant mammographic microcalcifications or when clear surgical margins cannot be achieved without generating a significant and not adjustable local deformity5,6.

Oncoplastic skills are incorporated in the surgical planning, both when using breast-conserving surgery or total mastectomy2,4.

Planning of Breast Conserving Oncoplastic Procedures

When a breast conserving approach is feasible, selection of the most appropriate technique is guided mainly by the location of the tumor, also taking into account the volume and shape of the breast, the size of the lesion and the morphologic changes that the surgical act is likely to determine.

For cancers that are small relative to breast size and do not require extensive parenchymal excisions, traditional techniques of breast-conserving surgery can be applied with excellent cosmetic results. But when resection of more than 20% of parenchymal volume is required for

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Introduction

Careful patient selection and preoperative planning are key components for the success of any oncoplastic operation for breast cancer.

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adequate local control, particularly for cancers located in the central, medial or lower pole of the breast, oncoplastic techniques acquire major importance to avoid the risk of an unpleasant cosmetic outcome\(^\text{7-11}\).

In our Center, planning for oncoplastic breast-conserving surgery includes:

- accurate preoperative skin marking according to the technique selected for parenchymal excision;
- evaluation of the most appropriate volume displacement or volume replacement technique to be used for reshaping of the post-resection defect;
- evaluation of the risk that the parenchymal excision may cause displacement of the nipple-areolar complex and adaptation of the skin drawings to assure that it may be repositioned to the center of the breast mound, if significantly displaced;
- evaluation of the need for symmetrization of the contralateral breast, and selection of the most appropriate technique.

The first step is to select the oncoplastic technique that can provide the most effective oncologic resection with the least cosmetic impairment and the dominant criteria that we use for selection is the location of the tumor within the breast. Breast size, age, general status and personal desires of the patient are also taken into account.

Planning for Periareolar Lesions

Oncoplastic volume displacement techniques provide excellent outcomes in the treatment of periareolar lesions. For breasts with moderate ptosis, we prefer a donut mastopexy or a batwing mastopexy, while for breasts with severe ptosis or redundant skin we favor a reduction mammoplasty pattern.

With a donut mastopexy approach, comfortable access can be gained to any lesion in the periareolar region as compared to traditional breast-conserving techniques. In this operation, two concentric circles of different diameter are designed around the nipple (Figure 1). The areolar skin is stretched only mildly when the inner circle is designed, to avoid that the final areolar diameter may result smaller than desired. The diameter of the inner circle is usually set between 4.0 and 4.5 cm, depending on the size of the breast. The diameter of the outer circle is designed so as not to exceed that of the original areola diameter by more than 20-25 mm, in order to prevent widening of the circumareolar scar or excessive flattening of the breast.

The initial step is the incision of the inner circle, which will represent the new border of the areola. The outer circle is then incised and the donut of skin between the two circles is excised. Quadrant resection of the breast parenchyma can then be performed through a wider incision, allowing for better control of the tumor removal than when the resection is performed through conventional conservative skin incisions. Reshaping of the breast can be performed appropriately by displacement of the residual gland. At this regard, we normally proceed to separate the residual gland off the pectoralis fascia using the electrocautery, paying attention to limit the number of major perforating vessels that are sectioned, in order not to threaten the blood supply to the residual glandular tissue. After careful haemostasis has been obtained, the residual breast parenchyma is reapproximated to facilitate a natural appearing breast. Sutures are placed in the deep portion of the residual gland, right above the fascia, to secure the posterior edges in their new position. We normally use 2-0 vicryl sutures for this purpose, while for reapproximation of the superficial portion of the breast we

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*Figure 1. In the donut mastopexy, two concentric circles of different diameter are designed around the nipple.*
use 4-0 absorbable sutures in the dermis. If needed, a purse-string suture is used to reduce the diameter of the larger circle and is then sutured to the new border of the areola, leaving only a periareolar scar at the end of the procedure (Figure 2). Axillary dissection is usually performed through a separate incision, but occasionally can be conducted through the same periareolar incision. If the two circles are concentric, the NAC is not elevated, while if the outer circle is centered around a point located higher than the existing nipple, the NAC can be slightly elevated as a consequence of the procedure. After completion of skin closure, the thorax of the patient is wrapped in an elastic bandage to reduce the risk of hematoma formation.

A batwing mastopexy pattern is ideal for cancers located in the upper periareolar region, particularly when the lesions are in proximity of the skin. Two half-circles are designed, one on the border of the areola and one 20-25 mm above it, and connected with angled wings on each side of the areola. Designing of the skin incisions should be made with the patient sitting erect. The areolar half-circle is incised first, followed by the upper half circle and the wings. Full-thickness lumpectomy is performed and the residual gland is lifted off over the pectoralis fascia to allow adequate advancement of tissue in order to remodel the defect. Remodeling of the breast defect is achieved with similar skills as indicated for the donut mastopexy. The procedure allows for ample removal of the skin overlying the lesion, and therefore can increase the safety of oncologic control of cancers located superficially.

Some uplifting of the NAC may result at the end of the procedure, but normally it does not determine significant asymmetry (Figure 3).

For breasts with severe ptosis, reduction mammoplasty patterns may offer better results. The resection of the tumor with wide macroscopically clear margins can be easily achieved in combination either with an inferior or superior pedicled flap to recreate a normally shaped breast and shift the NAC to an appropriate position.

**Planning for Central, Retroareolar Lesion**

For centrally located tumors, involving the retroareolar region or for Paget disease, several breast conserving oncoplastic procedures have been used in recent years as an alternative to total mastectomy. All these techniques include a complete excision of the tumor with the entire NAC and the correspondent underlying cylinder of parenchyma down to the pectoralis fascia. The central defect is then restored either with simple purse-string suture, linear sutures or skin-parenchymal flaps.

We usually utilize the Grisotti technique, as it is simple and offers excellent cosmetic results. With the patient in the sitting position, a circle is drawn along the borders of the areola. Another circle is drawn below the areola and lines from the medial and lateral sides of the upper circle are connected laterally on the inframammary fold (Figure 4).

Incisions are made along the drawings and the skin below the areola is excised, with exception of the skin included in the lower circle. The NAC
with the underlying tumor is completely excised down to the pectoralis fascia. The skin-glandular flap mobilized from the inferior lateral pole of the residual gland is used to create the new areola. The flap is incised medially down to the pectoralis fascia and separated from the latter to allow for adequate rotation and advancement. It 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 preserved skin is sutured to replace the excised areola. Care should be taken to avoid excessive devascularization of the skin-glandular flap, to minimize the risk of ischemic injury to the neo-areola. At the end of the procedure, the breast may result slightly smaller than the contralateral, but with a pleasant shape (Figure 5). If desired by the patient, reconstruction of the nipple can be performed immediately or at a later stage, with tattooing of the areola.

An alternative oncoplastic technique is a central quadrantectomy with complete excision of the NAC and subsequent “remodelling” of the breast. In particular, a circular periareolar cutaneous incision is made and extended down to the fascia of the large pectoral muscle, so as to permit the excision of a cone of glandular tissue, containing the tumour and wide margins of healthy tissue. Then, a “remodelling” of the breast is performed by the separation of the glandular tissue from the fascia of the large pectoral muscle and from the skin, extended around to about 5 cm from the edge of the wound. The circular skin defect, caused by the excision of the NAC, is closed using a purse-string suture with a 3-0 monofilament absorbable suture, without positioning a drain and avoiding deep parenchymal sutures. Immediately after the operation, the skin looked wrinkled in the center of the breast but it flattened in few weeks.

Planning for Lesions Located in the Lower Quadrants

Cancers located in the lower region of the breast expose to a higher risk of cosmetic failure if treated with standard lumpectomy techniques. Downturning of the NAC and/or introflection of the lower pole are often seen with these procedures.

For these lesions, we tend to prefer a reduction mammoplasty pattern, that may allow resection of large amounts of breast tissue with excellent cosmetic outcomes and wide surgical margins, even in small breasts.

A vertical pattern, a L-shaped pattern or a key-hole pattern incision may be used, and we normally prefer the latter. The patient is marked with the shoulders held back and level. A mark is made in the center of the sternal notch; each clavicle is marked 6 cm laterally from this sternal mark (Figure 6). A straight line is drawn from each clavicular mark to the nipple of the breast below. The center of the proposed nipple location is sited on this line, at a distance placed between 19 and 23 cm from the sternal notch mark, depending on the size of the patient. A circle of 5 cm diameter is drawn centered on the new nipple location and radial lines of 6 cm are designed from the lower half of the circle, and
connected in straight lines to markings previously made on the existing inframammary creases. Medially these lines should connect at about 1 cm from the midline, and should never reach the medial drawings of the contralateral breast. Marking of the lateral end of the inframammary crease is not on its natural ending (as it extends too laterally and too low), but rather is crossed superiorly on the mid-axillary line to terminate 2-3 cm superior to the crease. This end is connected with a straight line to the inferior end of the lateral wing.

The skin markings are progressively incised, and the lesion is completely excised with the overlying skin. The parenchymal excision is conducted down to the fascia of the pectoralis major muscle and a superior pedicle flap is created to mobilize the NAC. For cancers located in the infero-lateral or infero-medial quadrants, the parenchymal excision can be oriented as to include more lateral or medial portions of the breast. This requires more extended undermining of either the medial or lateral flap. After completing the parenchymal excision, the medial and lateral flaps are sutured together in order to restore the normal shape of the breast mound, leaving a vertical or L-shaped or a typical inverted T-scar (Figure 7).

A reduction mammoplasty approach results particularly convenient in women with very large and pendulous breasts, as it not only improves the cosmetic appearance of the breast but also can facilitate the delivery of postoperative radiotherapy. Due to the size of the breast, consistent positioning for radiotherapeutic treatment may be quite difficult in these patients, resulting in dosing inhomogeneity, a higher percentage of unacceptable late radiation reactions, and overall inadequate local treatment. By reducing the size of the breast with a mastoplastic approach, these risks may be avoided, without any significant interference with clinical or radiologic follow-up.

Planning for Lesions Located in the Upper Quadrants

Excision of small tumors located in the upper outer quadrant often does not require any particular reconstruction and adequate cosmetic results can be achieved simply by approximation in layers of the residual parenchyma. When the excision of the tumor generates a larger defect, either in the upper outer or upper inner quadrants, some form of reconstruction is mandatory. Volume replacement techniques may be considered in these cases, transferring autologous tissue from a remote site to fill the resection defect. This commonly involves the use of the latissimus dorsi, either as a muscle-subcutaneous flap, a musculocutaneous flap (including the overlying skin), or a muscle-sparing pedicled skin and fat-only flap. (TDAP = Thoraco Dorsal artery Perforator flap).

As the volume is restored, symmetry is usually maintained and contralateral surgery is rarely required. Complications of latissimus dorsi flap may include donor site morbidity, shoulder dysfunction and partial or total flap loss. Complication of TDAP flap (partial or total flap loss) are minimal. The cosmetic outcome is generally bet-
ter when replacement techniques are used to restore a defect in the upper outer quadrant.

If volume displacement techniques are used in these cases, repositioning of the NAC is usually required to guarantee good cosmetic results. The incision is therefore extended to include the entire border of the areola and a semicircular area of skin adjacent to the areola is removed on the side opposite to the excision; finally, the NAC moved to the tip of the new breast mound, with subcuticular 4-0 Biosyn sutures to close the skin.

Procedures on the Contralateral Breast

Independently from the location of the tumor or the choice of the oncoplastic procedure, reshaping of the contralateral breast may be included in the treatment planning. The option of mastopexy or volume reduction of the contralateral breast to improve symmetry and cosmetic outcome should be discussed with the patient, particularly in women of younger age or with large and pendulous breast. In case the oncoplastic procedure use the mammoplasty pattern, the same pattern should be used for the controlateral surgery. With a well-trained team, the operation can be conducted on both sides at the same time, thus reducing the surgical time.

If the difference between the two breasts is not excessive, we often utilize a concentric mastopexy, as it is relatively simple and fast, and allows to elevate the contralateral breast for a maximum of 2 cm. The decision to adopt this procedure can be taken at the end of the oncologic procedure, even directly at the operating table, if the need to better balance the cosmetic result becomes apparent (Figure 8), as the design for the concentric mastopexy can be made with the patient in the supine position. Reduction mammoplasty is more time consuming, but allows for more effective symmetrization, particularly when dealing with large, ptotic breasts that need major lifts. This procedure needs to be planned before surgery, as the markings have to be made with the patient in a standing or sitting position. When performing symmetrization procedures, the surgeon should take the opportunity to remove any suspicious tissue in the contralateral breast that may have been shown on the preoperative mammogram. In many series, this has resulted in a 5% detection rate of contralateral subclinical cancers.

Planning of Total Mastectomy and Breast Reconstruction

When a breast conserving approach cannot guarantee adequate local control and good cosmetic result, total mastectomy is selected. In this case, the option of immediate breast reconstruction is offered almost to all patients as it can improve the quality of life and does not interfere with further treatments. Patients scheduled for immediate breast reconstruction are evaluated jointly in the preoperative period by the breast surgeon and the plastic surgeon and at that time the options of autologous and prosthetic reconstruction are rediscussed in detail. In the Authors’ practice, prosthetic immediate reconstruction has its most favorable results in patients with small- or moderate-volume breasts with or without ptosis, who have not received and are not expected to receive radiotherapy, and particularly for bilateral reconstructions. It may also offer good results in selected patients with large breast. Autologous reconstruction is offered to all patients that have undergone preoperative radiotherapy (previous breast conserving surgery with radiotherapy) or will need to receive postoperative radiotherapy because of local extension of the disease. It is also offered to patients who will require a skin-reducing mastectomy for advanced breast cancer or cutaneous recurrences, in patients with large breast and surplus of abdominal tissues, and in patients unwilling to
endure an implant. Authors’ main choice for immediate autologous reconstruction is the DIEAP flap.

Planning for Total Mastectomy

When a final decision is made with the patient about the surgical strategy, cutaneous incisions and/or skin excision pattern for the total mastectomy are agreed upon between the breast surgeon and the plastic surgeon according to the principles of oncoplastic surgery in order to optimize the aesthetic results of the breast reconstruction.

The effort is to preserve the mammary skin envelope as much as possible, using skin-sparing techniques, and the same applies to the fascia of the pectoralis major muscle and the deep thoracic fascia, particularly when a prosthetic reconstruction is planned. The inframammary fold is also usually preserved to enhance the cosmetic results of the immediate reconstruction.

A skin-sparing mastectomy (SSM) is therefore the preferred choice, and we usually perform it through a periareolar incision (more than 70% of cases). All patients with small/medium breast and medium/large areolae are suitable candidates for periareolar SSM. For patients with small areolae (inferior to 3 cm) and large breast, a periareolar approach with a lateral extension (if prosthetic reconstruction is planned) or with vertical extension (if autogenous reconstruction is planned) is adopted to facilitate dissection and to avoid skin flap complications by excessive traction. In case of previous surgery to the index breast, or when the tumor is very close to a limited portion of skin, the SSM incision can be traced so as to include the areola and the scar or the skin overlying the tumor (if there is a small distance between them) (Figure 9 A-C). As an alternative, two separate skin incisions can be traced in order to avoid skin flap necrosis.

Skin Reducing Mastectomy (SRM) techniques may be selected either for oncological reasons (large superficial tumors, that are close to extended portions of skin) or for aesthetic reasons.

**Figure 9.** A, Preoperative view: skin incision including the areola and the scar of previous biopsy. B, C, Postoperative view at 8 months.
(patients with large and/or ptotic breasts). In these latter cases, SRM is performed utilizing the skin incision of the reduction mammoplasty (vertical, “L”, or inverted T patterns) in order to reduce the skin envelope (Figure 10 A-B). The vertical pattern is the most suitable, as it better preserves the vascularity of the mastectomy flaps. For symmetry reasons, the same pattern used for the SRM should be selected for the contralateral aesthetic procedure (Figure 11).

**Nipple-Sparing Mastectomy (NSM)** is considered only in strictly selected cases\textsuperscript{15-17}. The Authors favor the inferior periareolar incision because of its central position on the breast mound, but inframammary incision or even every incision from previous biopsy can suit to the NSM. Further surgical steps are the same than for SSM. Particular attention is payed to the thickness of the mastectomy flaps, especially under the NAC where a 3-4 mm cylinder of subareolar breast tissue is left, in order to reduce its post-operative morbidity, and to spare the deep thoracic fascia, if a prosthetic reconstruction is planned.

Axillary dissection is performed either through a separate axillary incision or through the mastectomy incision, depending on the size of the incision and the laxity of the skin.

**Prosthetic Breast Reconstruction**

Prosthetic breast reconstruction offers the advantages of minimal scarring, avoidance of donor-site morbidity, reduced operative times and faster postoperative recovery. It is well accepted by many patients who are unwilling to bear prolonged recovery and donor-site morbidity. If a prosthetic immediate reconstruction is planned, the Authors prefer a one-stage surgical approach, with the placement of a definitive anatomical silicone-filled textured prosthesis and contralateral symmetrization\textsuperscript{18,19}. The implant is placed in a subpectoral-subfascial pocket, undermining the pectoralis major muscle and the investing deep thoracic fascia which is elevated “in continuity” with the inferior edge of the pectoralis muscle. Thus, the implant is completely separated from the mastectomy flaps. Use of a tissue expander is limited to cases in which additional periareolar skin has been removed, thus rendering primary skin closure over the definitive implant difficult (5% of cases).

The patient is placed in hemi-seated position. A median line is drawn from the jugulus to the xifoid. The inframammary line is also traced bilaterally and tattooed. The “subpectoral-subfascial pocket” is thus created. Starting from the supero-lateral edge of the pectoralis major muscle, blunt undermining of the muscle is performed, then the fiber optic light retractor is inserted below the muscle, to elevate the inferior part of the muscle and in continuity the investing deep thoracic fascia up to inframammary fold. The base of the dissection is the costal cage superiorly, the anterior fascia of the rectus muscle inferiorly. At the level of the inframammary fold the subcutaneous tissue is entered up to its subdermal level. This manoeuvre helps to define the fold. The appropriate shape and size of the implant is selected according to the contralateral breast. The “subpectoral-subfascial pocket” is closed over the implant, in order to keep the subcutaneous tissue of the mastectomy flaps separated from the prosthesis. Whenever

![Figure 10. A, Preoperative view: possible skin incisions (circumareolar, small ellipse). B, Postoperative view at 6 months.](image-url)
is possible, the skin incision is closed by a purse-string in order to keep the final scar short. When a purse-string suture is performed, the skin envelope looks wrinkled after surgery, but will flatten in few weeks.

Contralateral surgery for symmetrization is performed as needed (70% of the cases in our practice). Reconstruction of the nipple-areola complex is usually delayed to a second stage, 1-2 months after the end of chemotherapy, in order to place the NAC in the correct position and to optimize the symmetry.

Prosthetic reconstruction leads to good aesthetic results, and the level of patient satisfaction is usually high. Immediate complications are limited, and mainly represented by infections ($5\%$) and partial necrosis of the mastectomy flaps ($7\%$). Periprosthetic infection is usually solved with e.v. antibiotics, and very rarely requires removal of the implant. Skin slough and/or small flap necrosis happen around the purse-string suture when the mastectomy flaps are very thin, and are usually managed with conservative measures. Extensive flap necrosis requiring explantation of the prosthesis occur very rarely. Seroma and hematoma are also rare.

Long term complications are mainly represented by capsular contracture ($3\%$) (II and IV grade according to Baker’s classification) that shifts toward autogenous reconstruction with the DIEAP flap.

**Dieap Flap Reconstruction**

DIEAP flap reconstruction follows the general guidelines as they are described in the literature$^{20-22}$: the DIEAP flap is raised on one or more abdominal perforators completely sparing the rectus muscle and its innervation thus reducing abdominal morbidity and is anastomosed to the internal mammary vessels. Anastomosing and molding the flap is performed through the circumareolar incision, eventually adding a short vertical incision if the periareolar one is very small, or through the mammoplasty pattern. Recent technical improvements come from the preoperative planning with the multidetector$^{23}$ that allows to choose the dominant perforator in the preoperative set. It enables to harvest the abdominal flap with the best angiosome thus enhancing the reliability of each flap.

In conclusion, the Authors recommend one-stage breast reconstruction for all mastectomy patients, either with definitive implant after SSM or with DIEAP flap. These techniques allow to achieve very good cosmetic results in a unique surgical stage with a low rate of complications.

Close cooperation between the breast surgeon and the plastic surgeon is essential to allow optimal care for these patients.

**Bullet Points**

- Careful patient selection and preoperative planning are key components for the success of any oncoplastic operation for breast cancer.
- The location of the tumor within the breast is the dominant criteria to select the most appropriate oncoplastic technique. Breast size, age, general status and personal desires of the patient are also taken into account.
- The donut or the batwing mastopexy are the techniques of choice for periareolar lesions, while for subareolar lesions a central quadrantectomy with the Grisotti technique is preferable
- Reduction mammoplasty techniques offer excellent results, both in terms of local control and cosmetic outcome, particularly for lesions that occur in pendulous breasts.
- The option of symmetrization of the contralateral breast should be proposed to the patient, particularly for women with higher cosmetic expectations.

**References**

1) BREDA R A, PET JY. Partial mastectomy: a balance between oncology and aesthetics? Lancet Oncol-
ogy 2005; 6: 130.


