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ONCOPLASTIC BREAST SURGERY: ONCOLOGICAL SAFETY AND AESTHETIC OUTCOMES IN BREAST-CONSERVING TREATMENT

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ABSTRACT

Breast-conserving surgery has become the standard treatment for most patients with early-stage breast cancer after studies demonstrated outcomes equivalent to mastectomy regarding overall survival and local disease control. Despite its oncological effectiveness and psychosocial benefits, tumor excision may lead to significant breast deformities, particularly when lesions are located in critical breast regions. In this context, oncoplastic breast surgery emerged as an approach that combines oncologic surgical principles with reconstructive plastic surgery techniques, allowing wider resections while preserving breast aesthetics. Oncoplastic procedures are classified into volume displacement and volume replacement techniques, with the choice depending on tumor characteristics and patient anatomy. Current evidence supports the oncological safety of these procedures, showing recurrence rates comparable to conventional breast-conserving surgery, as well as lower rates of positive margins and reoperations. Improved cosmetic outcomes positively influence self-esteem, body image, sexuality, and overall quality of life. Furthermore, advances in neoadjuvant therapies have expanded the indications for breast-conserving approaches associated with oncoplastic techniques. Today, oncoplastic surgery is recognized as an essential component of modern breast cancer management, combining oncological safety with superior aesthetic outcomes and greater patient satisfaction.

Keywords: Breast cancer, Breast-conserving surgery, Oncoplastic surgery, Quality of life, Breast reconstruction.

INTRODUCTION

Breast-conserving surgery has become established, over recent decades, as one of the main therapeutic strategies in the treatment of early-stage breast cancer. The paradigm shift in surgical treatment occurred following prospective randomized studies conducted in the 1970s and 1980s, particularly those carried out by the National Surgical Adjuvant Breast and Bowel Project (NSABP) and by the Milan group led by Umberto Veronesi. These studies demonstrated that breast-conserving surgery

combined with radiotherapy yielded outcomes equivalent to radical mastectomy in terms of overall survival and local disease control in appropriately selected patients. Since then, breast preservation has become the standard treatment for a large proportion of early-stage breast tumors.[1]

In addition to its oncological efficacy, breast-conserving surgery has a positive impact on patients' quality of life. Breast preservation is associated with better body image perception, preservation of femininity, and lower levels of psychological distress when compared with total mastectomy. However, although oncologically safe, tumor resection alone may result in significant breast deformities, particularly when large volumes of glandular tissue need to be removed. Tumors located in the lower quadrants, central region, or medial pole of the breast frequently result in scar retraction, anatomical distortion, and marked asymmetry after adjuvant radiotherapy, compromising the final aesthetic outcome.[2]

In this context, oncoplastic breast surgery emerged, integrating the principles of oncological surgery with concepts of reconstructive plastic surgery. The term "oncoplasty" was introduced in the 1990s by Audretsch, proposing the combination of wide oncological resections with immediate breast remodeling techniques. This approach made it possible to expand the indications for breast-conserving surgery, including cases previously considered unsuitable for breast preservation due to an unfavorable tumor size-to-breast volume ratio.[3]

Oncoplastic breast surgery is based on two fundamental principles: oncological safety and aesthetic optimization. The first objective is to achieve adequate surgical margins, reducing the risk of local recurrence. The second aims to minimize deformities and improve breast symmetry through glandular remodeling and tissue redistribution techniques. Studies have demonstrated that oncoplastic techniques allow wider resections without increasing tumor recurrence rates, while also significantly reducing the need for reoperations due to involved margins.[4]

Oncoplastic techniques can be classified into tissue displacement ("volume displacement") and tissue replacement ("volume replacement") procedures. Displacement techniques use the remaining breast tissue to remodel the breast after tumorectomy and are particularly indicated for patients with medium-sized or large breasts and some degree of ptosis. Among the most commonly used methods are therapeutic mammoplasties using superior, inferior, or superomedial pedicles. Tissue replacement techniques, in turn, use locoregional autologous flaps, such as the lateral thoracodorsal flap and the latissimus dorsi myocutaneous flap, allowing extensive defects to be filled in patients with small breasts.[5]

The choice of oncoplastic technique should take multiple factors into consideration, including tumor location and size, breast volume, degree of ptosis, need for radiotherapy, presence of comorbidities, and the patient's aesthetic expectations. Individualized surgical planning is essential to achieve satisfactory outcomes, and a multidisciplinary approach involving breast surgeons, plastic surgeons, radiation oncologists, pathologists, and medical oncologists is frequently required.[6]

From an oncological standpoint, recent evidence reinforces the safety of oncoplastic surgery. De Lorenzi et al. (2016), in a multicenter study involving thousands of patients, demonstrated similar local recurrence rates between conventional breast-conserving surgery and oncoplastic techniques. Furthermore, the possibility of wider resections is associated with a reduction in positive margins, a factor directly related to fewer reoperations and improved locoregional control. A meta-analysis conducted by Losken et al. (2014) showed lower rates of margin involvement in patients undergoing oncoplastic surgery when compared with traditional breast-conserving surgery.[6,7]

The aesthetic and psychosocial benefits are also widely described in the literature. Satisfactory cosmetic outcomes have a significant impact on patients' self-esteem, sexuality, and quality of life.

Studies using validated instruments, such as the BREAST-Q, demonstrate high levels of satisfaction after oncoplastic procedures, particularly when associated with contralateral symmetrization. In addition, patients undergoing oncoplastic surgery frequently exhibit better psychosocial adjustment and a lower perception of bodily mutilation.[8-10]

Another relevant aspect concerns the advances in neoadjuvant systemic therapies, which have further expanded the possibilities of breast-conserving surgery. Tumor reduction achieved with preoperative chemotherapy allows cases initially considered candidates for mastectomy to be converted to conservative approaches combined with oncoplastic surgery. This scenario reinforces the importance of multidisciplinary integration in the modern treatment of breast cancer.[11-14]

Currently, oncoplastic surgery is considered a fundamental part of the contemporary management of breast cancer and should not be understood merely as a complementary aesthetic resource, but rather as a therapeutic strategy capable of combining oncological safety, functional preservation, and improved quality of life. Continuous technical development, associated with the increasing emphasis on patient-centered outcomes, has consolidated oncoplastic surgery as one of the pillars of modern breast surgery.[15,16]

Fundamental Concepts of Oncoplastic Surgery

Oncoplastic breast surgery can be defined as the integration of the principles of oncological surgery and reconstructive plastic surgery techniques, with the aim of achieving adequate tumor resection while preserving the aesthetic and functional aspects of the breast. This approach seeks to ensure oncological safety without neglecting aspects related to the patient's body image, self-esteem, and quality of life.[1-5] The modern concept of oncoplastic surgery is based on the understanding that breast cancer treatment should not be restricted solely to local disease control but should also address the physical, emotional, and psychosocial impacts resulting from surgical treatment. Thus, oncoplastic surgery represents an evolution of traditional breast-conserving surgery, allowing wider resections with immediate reconstruction of the surgical defect.[6-10] Oncoplastic surgery is based on several essential principles that guide the planning and performance of the surgical procedure.

Tumor Resection with Adequate Margins

The primary principle of oncoplastic surgery remains oncological safety. Tumor resection must follow the same technical criteria as conventional breast-conserving surgery, ensuring complete removal of the lesion with negative margins. Achieving adequate surgical margins significantly reduces the risk of local recurrence and the need for reoperations.[11-16]

In this context, oncoplastic surgery offers an important advantage: the possibility of performing wider resections without compromising the final aesthetic outcome. This allows the breast surgeon greater surgical freedom, particularly in extensive tumors or tumors located in unfavorable regions of the breast. Studies have demonstrated lower rates of involved margins in oncoplastic procedures when compared with traditional breast-conserving surgery.

Three-Dimensional Planning of Resection

Unlike conventional lumpectomy, oncoplastic surgery requires detailed three-dimensional planning of breast resection. The surgeon must consider not only the size and location of the tumor but also anatomical factors related to breast shape, glandular volume, degree of ptosis, and position of the nipple-areola complex (NAC).

Tumor location directly influences the choice of reconstructive technique. Tumors located in the lower quadrants, for example, carry a greater risk of postoperative deformities, while central lesions often require specific approaches for preservation or reconstruction of the NAC. Preoperative planning includes a thorough clinical assessment, photographic documentation, and skin markings performed with the patient in the standing position.[10-16]

In addition, imaging examinations such as mammography, ultrasonography, and magnetic resonance imaging assist in accurately defining tumor extent and planning the resection.

Immediate Glandular Remodeling

After tumor removal, immediate remodeling of the remaining breast gland is performed. This principle constitutes one of the pillars of oncoplastic surgery and aims to prevent deformities secondary to the volume loss caused by resection.

Glandular remodeling may involve mobilization of local glandular flaps, rotation of breast segments, and tissue repositioning, allowing adequate filling of the surgical defect. Immediate reconstruction reduces scar retraction, contour irregularities, and anatomical distortions that tend to worsen after adjuvant radiotherapy.

Reorganization of breast tissue also promotes better distribution of scar tension, contributing to more durable aesthetic outcomes.[6-9]

Redistribution of the Remaining Breast Volume

Redistribution of the remaining breast tissue allows restoration of the natural breast shape after extensive resections. This concept is particularly important in tissue displacement ("volume displacement") techniques, in which the breast tissue itself is used to remodel the breast.

Therapeutic mammoplasties represent a classic example of this principle and are frequently used in patients with breast hypertrophy or moderate to severe ptosis. In these situations, in addition to oncological treatment, the patient may obtain an additional functional benefit related to reduced breast weight and improvement in musculoskeletal symptoms.

When the residual volume is insufficient for adequate remodeling, locoregional autologous flaps may be used, characterizing tissue replacement ("volume replacement") techniques.[1-4]

Contralateral Symmetrization

Breast symmetry represents a fundamental component of the final aesthetic outcome. In many cases, particularly in therapeutic mammoplasties, a simultaneous approach to the contralateral breast becomes necessary to achieve better body balance.

Symmetrization procedures may include reduction mammoplasty, mastopexy, or volumetric adjustments of the opposite breast. In addition to the aesthetic benefit, symmetrization contributes to better psychosocial adjustment of the patient and greater satisfaction with treatment.

Several studies have demonstrated that immediate symmetrization is associated with better quality-of-life and body satisfaction scores, particularly when performed during the same surgical procedure as the oncological resection.[1-5]

Preservation of the Vascular Supply to the Nipple-Areola Complex

Maintaining the viability of the nipple-areola complex (NAC) is a fundamental technical aspect of oncoplastic surgery. During surgical planning, the vascular pedicles responsible for the blood supply to the NAC must be

adequately preserved, minimizing the risk of necrosis, ischemic injury, and sensory changes.

The choice of pedicle depends on tumor location, the resection pattern, and the mammoplasty technique employed. Superior, inferior, medial, and superomedial pedicles may be used according to each clinical situation.

In addition to its aesthetic importance, preservation of the NAC has a strong psychological impact, since its integrity is closely related to the patient's perception of femininity and body identity.[3-8]

Integration of Oncological Safety and Aesthetic Outcomes

The main characteristic of oncoplastic surgery is the harmonious integration of oncological radicality and aesthetic preservation. Unlike the traditional view that prioritized tumor control exclusively, the contemporary approach recognizes that aesthetic and functional outcomes are also part of therapeutic success.

Thus, oncoplastic surgery should not be understood merely as a complementary reconstructive procedure, but rather as a comprehensive, patient-centered therapeutic strategy. The combination of oncological and reconstructive techniques allows for more individualized, safe, and less mutilating treatments, consolidating oncoplastic surgery as one of the pillars of modern breast cancer management.[10]

Indications for Oncoplastic Surgery in Breast-Conserving Surgery

Oncoplastic surgery is primarily indicated when conventional breast-conserving surgery presents a high risk of breast deformity, asymmetry, or an unsatisfactory aesthetic outcome. Its objective is to allow adequate oncological resections with negative margins, combined with immediate breast remodeling, preserving shape, volume, and symmetry.

The main indications include tumors that are proportionally large in relation to breast volume, lesions located in areas that are difficult to reconstruct aesthetically, the need for wide resections, medium-sized or large breasts, moderate or severe breast ptosis, pre-existing breast asymmetries, and patients who are candidates for adjuvant radiotherapy. International guidelines suggest considering oncoplastic techniques when resection exceeds approximately 20% of breast volume, when there is a full-thickness defect extending to the pectoral fascia, or when lumpectomy alone is likely to cause displacement of the nipple-areola complex.

The relationship between tumor volume and breast volume is one of the main factors in decision-making. Larger tumors, even when technically resectable, may produce significant retractions, depressions, and asymmetries after radiotherapy. In these cases, oncoplastic surgery allows wider resection and remodeling of the remaining parenchyma, reducing the risk of deformity. Clough et al. classify oncoplastic procedures according to levels of complexity, highlighting that smaller resections can be managed with simple remodeling, whereas more extensive resections generally require more elaborate mammoplasty techniques.

Tumor location is also a determining factor. Lesions in the lower quadrants, central region, medial pole, and junction of the inner quadrants carry a greater risk of deformities after conventional breast-conserving surgery. Central tumors may require partial or total resection of the nipple-areola complex, whereas tumors in the lower quadrants frequently cause inferior breast retraction and contour distortion. In these scenarios, the choice of mammoplasty pedicles, glandular flaps, or volume replacement techniques may better preserve breast shape.

Patients with medium-sized or large breasts and moderate or severe ptosis are particularly favorable candidates for tissue displacement techniques, such as therapeutic mammoplasties. These techniques allow tumor removal with wide margins, remodeling of the treated breast, and, when indicated, contralateral symmetrization during the same surgical procedure. In addition to the aesthetic benefit,

therapeutic breast reduction may improve symptoms related to breast hypertrophy, such as back pain, neck pain, and functional discomfort.

Oncoplastic surgery may also be indicated in selected cases of extensive ductal carcinoma in situ, limited multifocal or multicentric tumors, carefully selected local recurrence, and deformities following previous quadrantectomy. However, these indications require individualized assessment, with correlation between clinical examination, mammography, ultrasonography, magnetic resonance imaging when necessary, and multidisciplinary discussion. The international consensus conference on oncoplastic breast-conserving surgery reinforces the need for standardization of indications, surgical planning, and evaluation of oncological and aesthetic outcomes.

From an evidence-based perspective, oncoplastic surgery is associated with a reduction in involved margins, a lower need for reoperations, and a lower rate of conversion to mastectomy compared with conventional breast-conserving surgery. A meta-analysis reported a rate of positive or close margins of 12.3% in patients undergoing oncoplastic surgery, lower than that observed with traditional breast-conserving surgery in some series. Reviews and population-based studies also indicate a modest reduction in re-excision rates and a lower frequency of conversion to mastectomy after oncoplastic surgery.[6-12]

Contraindications

Despite its broad applicability, oncoplastic breast-conserving surgery should not be performed when it compromises oncological safety. The main absolute contraindication is the inability to achieve negative margins without excessive removal of breast volume. In this situation, mastectomy should be considered the safest alternative.

Other absolute contraindications include extensive prior breast radiotherapy, inflammatory breast disease, diffuse microcalcifications suspicious for extensive involvement, T4 tumors, and a tumor-to-breast ratio incompatible with an acceptable aesthetic outcome. Reviews of oncoplastic breast-conserving surgery reinforce that breast conservation is contraindicated when negative margins cannot be ensured, in T4 tumors, and in inflammatory disease.

Relative contraindications include heavy smoking, morbid obesity, uncontrolled diabetes, collagen vascular diseases, extensive multicentric tumors, and poor adherence to adjuvant treatment. These factors do not necessarily preclude surgery but increase the risk of complications, such as skin necrosis, ischemia of the nipple-areola complex, infection, dehiscence, seroma, and delay in the initiation of adjuvant radiotherapy.

Smoking deserves particular attention because it compromises microcirculation and wound healing, increasing the risk of flap and nipple-areola complex necrosis. Obesity and uncontrolled diabetes also increase the risk of infection and surgical wound complications. Collagen vascular diseases, in turn, may impair healing and increase radiotherapy-related toxicity, requiring joint assessment with medical oncology and radiation oncology.

Finally, poor adherence to adjuvant treatment constitutes an important relative contraindication, since breast-conserving surgery depends on the appropriate completion of adjuvant radiotherapy and oncological follow-up. Thus, the indication for oncoplastic surgery should always consider not only the technical feasibility of surgery but also the patient's clinical, social, and therapeutic context.[6,7]

Classification of Oncoplastic Techniques

Oncoplastic techniques used in breast-conserving surgery can be classified into two major groups: volume displacement techniques ("volume displacement") and volume replacement techniques

("volume replacement"). This classification is based on how the surgical defect is reconstructed after tumor resection and constitutes one of the pillars of reconstructive planning in oncoplastic surgery.

The choice between one modality and the other depends on several factors, including breast volume, tumor-to-breast ratio, lesion location, degree of ptosis, need for wide resections, and the experience of the surgical team. Both strategies aim to preserve oncological safety while simultaneously optimizing aesthetic and functional outcomes.[1-3]

Volume Displacement Techniques

Volume displacement techniques are based on the mobilization, rotation, and redistribution of residual breast tissue to fill the defect created by tumor resection. These techniques use exclusively the breast's own tissue for glandular remodeling, without the need to transfer tissue from other regions of the body.

They are particularly indicated in patients with medium-sized or large breasts, especially when there is moderate or severe breast ptosis. In these cases, there is sufficient glandular tissue to allow adequate remodeling after lumpectomy. In general, these techniques are recommended when the resection corresponds to approximately 20% to 30% of breast volume, although more complex procedures may allow even larger resections in selected situations.

In addition to reconstruction of the surgical defect, displacement techniques frequently provide an overall aesthetic improvement of the breast and may correct breast hypertrophy, sagging, and pre-existing asymmetries. The combination with contralateral symmetrization procedures contributes to better cosmetic outcomes and greater patient satisfaction.

Clough et al. proposed a classification of oncoplastic techniques based on the resected volume and reconstructive complexity. Level I procedures involve smaller resections with simple remodeling, whereas Level II procedures include larger resections associated with more elaborate therapeutic mammoplasty techniques.[6-12]

Main Indications

Volume displacement techniques are most indicated in:

- Medium-sized or large breasts;
- Patients with moderate or severe breast ptosis;
- Need for resection of up to 20–30% of breast volume;
- Tumors located in regions amenable to glandular remodeling;
- Patients who are candidates for therapeutic reduction mammoplasty;
- Cases in which breast symmetrization is desired.

Advantages

The main advantages of these techniques include:

- Use of autologous tissue from the breast itself;
- Better texture and consistency of the reconstruction;
- Lower donor-site morbidity;
- Possibility of immediate symmetrization;
- Frequently superior aesthetic outcomes;
- Simultaneous correction of breast ptosis.

However, these techniques may not be suitable for patients with small breasts or very extensive

defects, in which the residual volume is insufficient for adequate remodeling.

Therapeutic Reduction Mammoplasty

Therapeutic reduction mammoplasty represents one of the most commonly used techniques in oncoplastic surgery. It consists of the combination of oncological quadrantectomy and conventional reduction mammoplasty techniques.

The tumor is incorporated into the mammoplasty resection pattern, allowing wide glandular resection and simultaneous breast remodeling. The choice of vascular pedicle for the nipple-areola complex depends on tumor location and the planned reduction pattern.

This technique provides excellent outcomes in patients with breast hypertrophy, providing not only adequate oncological control but also functional improvement related to the reduction in breast weight.[1-5]

Oncoplastic Mastopexy

Oncoplastic mastopexy uses principles similar to those of aesthetic mastopexy to remodel the breast after tumor resection. It is particularly indicated in patients with moderate ptosis and preserved breast volume.

In addition to reconstruction of the defect, it promotes repositioning of the nipple-areola complex and improvement of breast contour.

Local Glandular Flaps

Local glandular flaps consist of the mobilization of segments of adjacent breast parenchyma to fill the surgical defect. They are widely used in smaller resections and localized defects.

They may be used alone or in combination with more complex mammoplasty techniques.

Volume Replacement Techniques

Volume replacement techniques use autologous tissues from regions adjacent to or distant from the breast to reconstruct the surgical defect. Unlike displacement techniques, in these situations the lost volume is replaced with tissue from outside the breast.

They are particularly indicated in patients with small breasts, limited glandular tissue availability, or a need for extensive resections. They also play an important role in defects located in specific quadrants that are difficult to remodel, particularly the lateral and lower quadrants and the central region.

These techniques allow the indications for breast-conserving surgery to be expanded even in situations in which glandular remodeling alone would be insufficient.[6,7]

Main Indications

Volume replacement techniques are most indicated in:

- Small breasts;
- Extensive resections;
- Unfavorable tumor-to-breast ratio;
- Defects located in specific quadrants;
- Patients without an indication for reduction mammoplasty;
- Selected cases of local recurrence.

Advantages

The main advantages include:

- Possibility of breast preservation in extensive defects;
- Better volume replacement;
- Less distortion of the residual breast;
- Applicability in thin patients or those with low glandular volume.

However, these techniques are associated with greater surgical complexity and a potential increase in donor-site morbidity.

Latissimus Dorsi Muscle Flap

The latissimus dorsi myocutaneous flap is one of the most traditional volume replacement techniques. It uses muscle, subcutaneous tissue, and, when necessary, skin from the dorsal region to fill the breast defect.

It has a reliable blood supply and great reconstructive versatility, being particularly useful for extensive defects of the lateral breast quadrants.

Lateral Thoracodorsal Flap

The lateral thoracodorsal flap uses lateral adipocutaneous tissue from the chest wall for partial breast volume replacement. It is a less invasive technique than the classic latissimus dorsi flap, with lower functional morbidity.

Lateral Intercostal Flap

The lateral intercostal flap is based on the blood supply from the lateral intercostal vessels. It allows reconstruction of defects located mainly in the lateral and lower quadrants.

LICAP (Lateral Intercostal Artery Perforator)

The LICAP flap uses perforators of the lateral intercostal artery without the need to sacrifice muscle. It is a modern technique for partial breast reconstruction with lower morbidity and better functional preservation.

The LICAP flap provides good outcomes in lateral breast defects and has gained widespread acceptance due to less postoperative pain and reduced functional impairment.

TDAP (Thoracodorsal Artery Perforator)

The TDAP flap uses perforators of the thoracodorsal artery while preserving the latissimus dorsi muscle. It constitutes a less invasive alternative to the classic muscle flap, reducing donor-site morbidity.

It offers excellent reconstructive versatility and good cosmetic outcomes, particularly in moderate defects of the lateral breast.

Preoperative Planning in Oncoplastic Surgery

Preoperative planning constitutes one of the most important stages of oncoplastic breast surgery. Unlike conventional breast-conserving surgery, the oncoplastic approach requires detailed integration of oncological, anatomical, and reconstructive principles, making an individualized and multidisciplinary assessment essential.

The success of surgery depends not only on adequate tumor resection but also on the ability to predict the volumetric and aesthetic impact of the resection on the breast. Thus, adequate preoperative

planning is directly related to achieving negative surgical margins, reducing reoperation rates, preserving breast symmetry, and improving patient satisfaction.

Several studies have demonstrated that failures in preoperative planning are associated with higher rates of aesthetic deformities, asymmetries, and the need for delayed corrective procedures. Therefore, oncoplastic surgery requires careful assessment of the patient, the tumor, and reconstructive options even before the surgical incision.[5-10]

Clinical Assessment

Clinical assessment represents the first step in oncoplastic planning. It should be performed thoroughly, considering the anatomical characteristics of the breast, oncological factors, and the patient's individual expectations.

Breast Volume

Breast volume plays a central role in defining the reconstructive strategy. Patients with medium-sized or large breasts generally have greater availability of glandular tissue, favoring volume displacement techniques, such as therapeutic mammoplasties and oncoplastic mastopexies.

Patients with small breasts, on the other hand, have less tissue reserve, making volume replacement techniques with autologous flaps more frequently necessary. The relationship between tumor volume and breast volume is considered one of the main determinants of the risk of postoperative deformity.

Studies have demonstrated that resections exceeding approximately 20% of breast volume are associated with poorer aesthetic outcomes when not accompanied by adequate oncoplastic remodeling.[4-9]

Degree of Ptosis

The degree of breast ptosis directly influences the choice of reconstructive technique. Patients with moderate or severe ptosis frequently benefit from therapeutic mammoplasties, allowing simultaneous oncological treatment, breast remodeling, and overall aesthetic improvement.

Assessment of ptosis also assists in determining the vascular pedicle of the nipple-areola complex (NAC), planning the incisions, and determining the need for contralateral symmetrization.

Tumor-to-Breast Ratio

The ratio between tumor size and breast volume is one of the main criteria for indicating oncoplastic breast-conserving surgery. Relatively large tumors in small breasts carry a greater risk of deformity and may require more complex reconstructive techniques.

This assessment should consider not only tumor diameter but also the three-dimensional extent of the resection, the need for wider margins, and the potential impact of radiotherapy on the residual breast.

Tumor Location

Tumor location significantly influences the cosmetic outcome and the choice of surgical technique. Lesions in the lower quadrants, central region, and medial pole have a greater potential for aesthetic distortion after conventional breast-conserving surgery.

Central tumors frequently require reconstruction of the NAC, whereas lateral lesions can be more easily approached using local flaps or glandular techniques.

Clough et al. developed a quadrant-by-quadrant atlas relating tumor location to specific oncoplastic strategies, emphasizing the importance of individualized anatomical planning.

Comorbidities

The presence of comorbidities should be carefully assessed due to their impact on wound healing, tissue vascularization, and the risk of complications.

The most relevant factors include:

- Smoking;
- Diabetes mellitus;
- Obesity;
- Arterial hypertension;
- Collagen vascular diseases;
- Cardiovascular diseases;
- Chronic corticosteroid use.

Patients who smoke have a higher risk of skin necrosis and vascular compromise of the NAC. Obesity and diabetes are also associated with an increased risk of infectious complications and surgical wound dehiscence.

Patient Expectations

Oncoplastic surgery should be patient-centered, and understanding the patient's expectations regarding treatment, breast shape, scars, and body symmetry is essential.

Informed consent should include a detailed discussion of:

- Possibility of residual asymmetry;
- Need for contralateral symmetrization;
- Possible future surgical revisions;
- Impact of radiotherapy;
- Expected scars;
- Risks and complications.

Studies using instruments such as the BREAST-Q demonstrate that adequate alignment between expectations and surgical outcomes is strongly associated with postoperative satisfaction.

Radiological Assessment

Imaging assessment is essential in the planning of oncoplastic surgery, allowing precise definition of tumor extent and assisting in the choice of reconstructive technique.

Mammography

Mammography remains a fundamental examination in the preoperative assessment. It allows identification of tumor extent, the presence of microcalcifications, multifocality, and multicentricity.

In addition, it assists in determining the relationship between the tumor and important anatomical structures, such as the nipple-areola complex.

Ultrasonography

Ultrasonography complements mammography, particularly in dense breasts. It allows a more detailed assessment of tumor dimensions, the relationship with deep tissue planes, and the

evaluation of suspicious axillary lymph nodes.

It also plays an important role in the preoperative localization of non-palpable lesions.

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) has high sensitivity in the assessment of tumor extent and is particularly useful in selected situations, such as:

- Dense breasts;
- Invasive lobular tumors;
- Suspected multifocality;
- Assessment after neoadjuvant chemotherapy;
- Planning of complex cases.

However, indiscriminate use of MRI may increase mastectomy rates without a proven survival benefit; therefore, its indication should be individualized.

Preoperative Tumor Localization

Preoperative localization is essential for non-palpable lesions. Techniques such as wire-guided localization, radioactive localization, magnetic seeds, and radar markers allow precise localization of the lesion during surgery.

Adequate tumor localization reduces the risk of involved margins and minimizes excessive removal of healthy tissue.

Aesthetic Planning

Oncoplastic surgery requires aesthetic planning as rigorous as oncological planning. The objective is to minimize deformities and preserve body harmony.

Affected Quadrant

Each breast quadrant presents specific reconstructive challenges. Tumors in the lower quadrants generally require more elaborate mammoplasty techniques due to the greater risk of retraction.

Lateral lesions can frequently be treated with local flaps or less complex techniques.

Amount of Tissue to Be Removed

Volumetric estimation of the resection directly influences the choice of reconstructive technique. Small defects can be corrected with simple remodeling, whereas larger defects frequently require therapeutic mammoplasties or volume replacement flaps.

Contralateral Symmetry

Symmetrization of the contralateral breast may be performed during the same surgical procedure to improve body balance and aesthetic satisfaction.

The most common procedures include:

- Mastopexy;
- Reduction mammoplasty;
- Volume adjustments.

The decision should consider the patient's preference, pre-existing asymmetry, and the impact

of radiotherapy on the treated breast.

Planned Scars

The positioning of incisions should simultaneously consider adequate oncological access and cosmetic outcome. Scars should be strategically planned, respecting skin tension lines and the principles of mammoplasty techniques.

"Inverted-T," vertical, periareolar, and lateral patterns may be used according to the technique selected.

Oncoplastic Techniques by Breast Quadrant

Tumor location represents one of the main determining factors in the planning of oncoplastic breast surgery. Each breast quadrant has specific anatomical characteristics related to glandular distribution, vascularization, tissue mobility, and the aesthetic impact of resection. Thus, the choice of reconstructive technique should be individualized according to the affected quadrant, aiming to preserve breast symmetry, minimize deformities, and ensure adequate oncological safety.

Clough et al. proposed an important quadrant-by-quadrant atlas for oncoplastic surgery, demonstrating that certain techniques provide better outcomes according to tumor location. Understanding these anatomical particularities allows optimization of surgical planning and reduction of late aesthetic complications.[5-10]

Upper Quadrants

The upper quadrants of the breast generally provide better conditions for breast-conserving surgery due to greater glandular mobility and the possibility of more favorable tissue redistribution. The greater volume in the upper pole facilitates remodeling after tumor resection, frequently resulting in better cosmetic outcomes.

In addition, scars located in the upper quadrants tend to be less noticeable and less susceptible to visible retraction after radiotherapy.

Techniques Used

Simple Glandular Remodeling

Simple glandular remodeling consists of mobilizing adjacent breast tissue to fill the surgical defect. It is particularly useful for small or moderate resections located in the upper outer quadrants. This technique has low morbidity and preserves the natural contour of the breast.

Superior Pedicle

The superior pedicle is widely used in therapeutic mammoplasties for tumors located in the lower or central regions, preserving the blood supply to the nipple-areola complex through the superior vascular supply.

It provides good vascular viability and adequate glandular mobility.

Round Block Technique

The round block technique allows wide periareolar access with excellent scar camouflage. It is particularly useful for upper lesions close to the NAC and for small to moderate tumors.

Periareolar Mastopexy

Periareolar mastopexy may be used to correct minor deformities and reposition the nipple-areola complex after upper resections.

Lower Quadrants

The lower quadrants represent one of the most challenging regions in breast-conserving surgery. Tumor resection in this location frequently results in retraction of the lower pole, a deformity known as "bird beak deformity," elevation of the inframammary fold, and distortion of the breast contour. These deformities tend to worsen after radiotherapy due to tissue fibrosis.

For this reason, tumors in the lower quadrants frequently require more elaborate oncoplastic techniques.

Techniques Used

Therapeutic Mammoplasty

Therapeutic mammoplasty is considered one of the best options for lower defects, allowing wide glandular resection combined with immediate breast remodeling.

Patients with medium-sized or large breasts and breast ptosis achieve excellent outcomes with this approach.

Superior or Superomedial Pedicle

The use of superior or superomedial pedicles allows better filling of the lower pole after tumor resection. These techniques favor maintenance of breast projection and adequate vascularization of the NAC.

The superomedial pedicle has gained prominence due to its good mobility, vascular safety, and consistent aesthetic outcomes.

Local Flaps

In extensive defects or patients with lower breast volume, local adipocutaneous flaps may be used for additional filling of the lower defect.

Medial Quadrants

The medial quadrants represent an important reconstructive challenge due to the risk of breast cleavage asymmetry. Small deformities in this region become easily noticeable due to the central position of the breast.

In addition, medial scars tend to be more visible and may significantly compromise the aesthetic outcome.

Reconstructive Options

Rotational Glandular Flaps

Rotational mobilization of adjacent breast tissue allows filling of the medial defect while preserving the inner contour of the breast.

These flaps provide good outcomes in small and moderate defects.

Periareolar Techniques

Periareolar techniques provide adequate aesthetic access for lesions close to the nipple-areola complex, reducing scar visibility.

The round block technique is particularly useful for medial periareolar lesions.

Local Chest Wall Flaps

In larger defects, adipocutaneous flaps from the medial chest wall may be used to replace the lost volume.

Lateral Quadrants

The lateral quadrants generally provide better conditions for reconstruction due to the greater availability of lateral tissue and proximity to the chest wall.

These regions are particularly suitable for perforator flaps and volume replacement techniques.

Techniques Used

LICAP (Lateral Intercostal Artery Perforator)

The LICAP flap uses perforators from the lateral intercostal arteries for the reconstruction of lateral breast defects.

It is a modern and widely used technique due to the following advantages:

- Muscle preservation;
- Low morbidity;
- Good mobility;
- Less postoperative pain;
- Functional preservation.

Studies have demonstrated good cosmetic outcomes and low donor-site morbidity.

Lateral Thoracodorsal Flap

The lateral thoracodorsal flap uses lateral adipocutaneous tissue without the need for extensive muscle dissection. It is useful for moderate defects of the lateral quadrants.

Lateral Glandular Advancement

Advancement of the lateral glandular tissue allows small defects to be filled without the need for additional flaps.

Therapeutic Mammoplasty

Therapeutic mammoplasty represents one of the most widely used and studied techniques in modern oncoplastic surgery. It consists of the combination of wide tumor resection with reduction mammoplasty or mastopexy techniques.

This approach allows:

- Wider surgical margins;
- Immediate breast remodeling;
- Bilateral symmetrization;
- Correction of breast ptosis;
- Preservation of breast shape.

Advantages

Several studies have demonstrated important benefits of therapeutic mammoplasty.

Excellent Aesthetic Outcome

Immediate breast remodeling reduces deformities and improves body symmetry.

Better Radiotherapy Distribution

Glandular reorganization promotes a more homogeneous distribution of the radiotherapy dose, reducing localized retractions.

Functional Benefit in Macromastia

Patients with breast hypertrophy frequently experience improvement in:

- Neck pain;
- Back pain;
- Shoulder grooves;
- Postural limitations.

Lower Reoperation Rates

The possibility of wider resections reduces the rates of involved margins.

Meta-analyses have demonstrated lower re-excision rates compared with conventional breast-conserving surgery.

Disadvantages

Despite the benefits, some limitations should be considered:

- Longer operative time;
- Extensive scars;
- Possibility of NAC necrosis;
- Sensory changes;
- Greater technical complexity.

Vascular complications of the NAC are more frequent in patients who smoke, are obese, or have diabetes.

Round Block Technique

The round block technique, described by Benelli, represents an important option for central or periareolar tumors.

It is based on:

- Double periareolar incision;
- Extensive glandular dissection;
- Centripetal remodeling;
- Excellent scar camouflage.

Indications

The technique provides better outcomes in:

- Small tumors;
- Small or medium-sized breasts;
- Lesions close to the NAC;
- Patients with mild ptosis.

Advantages

- Minimally visible scar;
- Good symmetry;

• Aesthetic preservation of the breast;
• Wide surgical access for central tumors.

Limitations

The technique has limitations in:
• Extensive resections;
• Severely ptotic breasts;
• Peripheral tumors;
• Large glandular defects.

In these situations, areolar widening, breast flattening, or residual deformity may occur.

Local and Perforator Flaps

The evolution of perforator flaps has revolutionized contemporary oncoplastic surgery. These techniques allow volume reconstruction with lower functional morbidity, preserving muscles and reducing donor-site complications.

LICAP

The LICAP flap is based on lateral intercostal perforator vessels and has become one of the main options for partial reconstruction of the lateral breast.

Advantages

• Muscle preservation;
• Low morbidity;
• Good mobility;
• Less postoperative pain;
• Faster functional recovery.

It provides excellent outcomes in lateral and lower defects.

TDAP

The TDAP flap uses thoracodorsal artery perforators without the need to sacrifice the latissimus dorsi muscle.

This technique offers:
• Less pain;
• Functional preservation;
• Lower dorsal morbidity;
• Good reconstructive volume;
• Better postoperative recovery.

Currently, the TDAP is considered a modern alternative to the classic latissimus dorsi flap in selected cases.

Surgical Margins and Oncological Safety

Oncological safety constitutes the fundamental principle of oncoplastic breast surgery. Although oncoplastic surgery is distinguished by the combination of oncological treatment and immediate aesthetic reconstruction, no cosmetic benefit should compromise the surgical radicality required for

adequate local disease control. Thus, the same oncological principles applied to conventional breast-conserving surgery must be rigorously observed during oncoplastic procedures.

Historically, there was concern that immediate breast remodeling could hinder the pathological assessment of margins, compromise future reoperations, or increase the risk of local recurrence. However, prospective studies, systematic reviews, and international consensus statements have demonstrated that, when properly performed by trained teams, oncoplastic surgery provides oncological safety comparable to conventional breast-conserving surgery, in addition to advantages related to lower rates of involved margins and a reduced need for reoperations.[6,7]

Fundamental Oncological Objectives

Oncoplastic surgery must adhere to the classic principles of breast oncological surgery, including:

- Complete resection of the lesion;
- Achievement of negative surgical margins;
- Adequate anatomical orientation of the surgical specimen;
- Radiological and pathological correlation;
- Adequate axillary staging when indicated;
- Integrated planning with radiotherapy and systemic therapies.

The primary objective remains local disease control, with the aesthetic outcome considered a complementary benefit rather than a substitute for oncological safety.

Complete Resection of the Lesion

Complete tumor resection represents the main determinant of the effectiveness of breast-conserving surgery. In oncoplastic surgery, the possibility of immediate remodeling allows the surgeon to perform wider resections without concern for significant aesthetic deformity.

This aspect constitutes one of the greatest advantages of modern oncoplastic surgery, particularly in larger tumors or tumors located in regions traditionally considered unfavorable for breast-conserving surgery.

Studies have demonstrated that oncoplastic techniques frequently allow the removal of a greater volume of glandular tissue compared with conventional lumpectomy, reducing the risk of positive margins.

In addition, the freedom to widen the margins may reduce the need for conversion to mastectomy in selected cases.[6,10]

Negative Surgical Margins

Achieving negative margins is one of the main factors associated with reducing local recurrence in breast cancer. According to the current consensus of the Society of Surgical Oncology (SSO) and the American Society for Radiation Oncology (ASTRO), an adequate margin for invasive carcinoma is defined as the absence of tumor on ink (“no ink on tumor”).

For ductal carcinoma in situ (DCIS), margins of at least 2 mm are generally recommended to reduce the risk of local recurrence.

In oncoplastic surgery, the possibility of wider resections favors the achievement of adequate margins. Several series have demonstrated lower rates of involved margins compared with conventional breast-conserving surgery.

A meta-analysis published by Losken et al. found lower re-excision rates in patients undergoing oncoplastic surgery, suggesting an oncological benefit associated with wider resections.

Anatomical Orientation of the Surgical Specimen

Adequate anatomical orientation of the surgical specimen is an essential step in oncoplastic surgery. After wide resections and glandular remodeling, it becomes extremely difficult to identify the tumor bed if margin re-excision is required.

For this reason, the surgical specimen should be carefully oriented with sutures, clips, or anatomical markers, identifying:

- Superior margin;
- Inferior margin;
- Medial margin;
- Lateral margin;
- Deep margin;
- Superficial margin.

Effective communication among the surgeon, radiologist, and pathologist is essential for the correct interpretation of the margins.

In addition, the placement of metallic clips in the tumor bed assists in planning adjuvant radiotherapy, particularly in the administration of a “boost” to the area at greatest risk.

Radiological and Pathological Correlation

The correlation between radiological and pathological findings is critically important in oncoplastic breast-conserving surgery.

This process involves:

- Confirmation of complete removal of the lesion;
- Assessment of microcalcifications;
- Verification of margins;
- Correlation among clinical, radiological, and pathological tumor size.

In non-palpable lesions, intraoperative radiography of the surgical specimen is an important tool for ensuring complete inclusion of the tumor target.

In cases of DCIS or multifocal tumors, this step becomes even more relevant due to the greater risk of underestimating the extent of the disease.

Impact of Oncoplastic Surgery on Surgical Margins

Several studies have demonstrated that oncoplastic surgery is associated with reduced rates of positive margins and a consequent decrease in the need for reoperations.

This advantage results mainly from:

- Greater freedom to perform wide resections;
- Better three-dimensional planning;
- Less concern regarding immediate aesthetic deformity;
- Possibility of simultaneous reconstruction.

Fitoussi et al., in an analysis of 540 consecutive cases of oncoplastic surgery, demonstrated low rates of involved margins associated with good aesthetic outcomes.

In addition, recent population-based studies suggest a lower rate of secondary mastectomy in patients undergoing oncoplastic surgery.

Need for Reoperations

The presence of positive margins frequently requires a new surgical intervention, increasing morbidity, costs, and psychological impact.

Oncoplastic surgery offers a potential benefit in reducing reoperations due to the possibility of a wider initial resection.

Reoperations after glandular remodeling may be technically more complex due to the altered anatomy of the breast. Therefore, adequate initial planning and the achievement of negative margins become even more important.

The literature consistently demonstrates lower re-excision rates with oncoplastic techniques compared with traditional breast-conserving surgery.

Local Recurrence and Survival

One of the main concerns related to oncoplastic surgery is the risk of local recurrence. However, current evidence demonstrates recurrence rates similar to those observed with conventional breast-conserving surgery.

De Lorenzi et al., in a study involving a large number of patients with long-term follow-up, observed comparable oncological safety between oncoplastic surgery and traditional breast-conserving surgery. Likewise, systematic reviews and meta-analyses have demonstrated no adverse impact on:

- Overall survival;
- Disease-free survival;
- Locoregional control.

These findings reinforce that oncoplastic surgery represents an oncologically safe technique when performed with appropriate patient selection.

Radiotherapy after Oncoplastic Surgery

Adjuvant radiotherapy remains a fundamental component of breast-conserving treatment for breast cancer, including after oncoplastic procedures. Its main purpose is to reduce the risk of local recurrence, contributing significantly to locoregional disease control and improved long-term survival rates.

Several landmark studies have demonstrated that the combination of breast-conserving surgery and radiotherapy provides oncological efficacy equivalent to mastectomy in appropriately selected patients. Thus, even after complex oncoplastic reconstructions, radiotherapy continues to be considered mandatory for most patients undergoing breast preservation.

However, oncoplastic surgery introduces new challenges for radiotherapy planning, mainly due to the anatomical changes resulting from glandular remodeling. Redistribution of breast tissue may alter the original location of the tumor bed, making precise delineation of the area at greatest risk for local recurrence more difficult.

For this reason, multidisciplinary integration among the breast surgeon, radiation oncologist, radiologist, and pathologist has become an essential element in ensuring adequate delivery of radiotherapy after oncoplastic surgery.[6,7]

Importance of Radiotherapy in Breast-Conserving Surgery

Radiotherapy after breast-conserving surgery significantly reduces local recurrence rates and improves long-term oncological outcomes.

Meta-analyses by the Early Breast Cancer Trialists' Collaborative Group (EBCTCG) have demonstrated that radiotherapy after breast-conserving surgery reduces the risk of local recurrence by approximately half and contributes to a reduction in breast cancer-specific mortality.

Thus, oncoplastic procedures do not eliminate the need for radiotherapy, even in cases with excellent surgical margins or a favorable pathological response.

The indication for radiotherapy should follow the same principles as those applied to conventional breast-conserving surgery.

Challenges of Radiotherapy after Oncoplastic Surgery

Although oncoplastic surgery provides important aesthetic and functional benefits, breast remodeling may create technical difficulties in radiotherapy planning.

The main challenges include:

• Identification of the tumor bed;
• Anatomical changes in the breast;
• Glandular redistribution;
• Displacement of the original resection site;
• Changes in breast contour;
• Difficulty in administering the "boost."

These changes make adequate intraoperative planning and communication among the teams involved essential.

Tumor Bed Localization

Accurate identification of the tumor bed constitutes one of the main challenges of radiotherapy after oncoplastic surgery.

In conventional breast-conserving surgery, the lumpectomy bed generally remains relatively anatomically preserved. However, in oncoplastic surgery, significant mobilization of breast tissue occurs, which may completely displace the original resection area.

This situation makes the following more difficult:

• Delineation of the radiotherapy boost area ("boost");
• Planning of radiation fields;
• Interpretation of postoperative images.

This difficulty becomes even greater with therapeutic mammoplasty techniques and extensive glandular remodeling.

Studies have demonstrated that failure to adequately identify the tumor bed may compromise the accuracy of the "boost" and potentially increase the risk of local failure.

Need for Surgical Clips

The placement of metallic surgical clips in the tumor bed currently represents one of the most important measures for adequate radiotherapy planning after oncoplastic surgery.

The clips serve as radiopaque anatomical markers, allowing precise identification of the resected area during computed tomography-based radiotherapy planning.

The placement of multiple clips at the margins of the tumor bed is recommended, generally including:

• Superior margin;

• Inferior margin;
• Medial margin;
• Lateral margin;
• Deep margin.

Adequate three-dimensional marking significantly assists the radiation oncologist in delineating the target volume.

International consensus statements reinforce the importance of systematic clip placement in oncoplastic procedures due to the anatomical changes caused by breast remodeling.

Changes in Dose Distribution

Breast remodeling modifies the geometry of the irradiated breast and may alter radiotherapy dose distribution.

The main factors involved include:
• Glandular redistribution;
• Changes in breast shape;
• Volume reduction;
• Displacement of the tumor bed;
• Changes in tissue thickness.

These changes may influence:
• Dose homogeneity;
• Target volume coverage;
• Skin toxicity;
• Late fibrosis;
• Final aesthetic outcome.

However, some studies suggest that therapeutic mammoplasty may promote a more homogeneous distribution of radiation due to improved breast shape after remodeling.

In addition, reduction in breast volume may decrease areas of dose overlap and reduce skin toxicity in patients with macromastia.

Radiotherapy Boost

The "boost" consists of an additional dose of radiation administered specifically to the tumor bed, with the aim of reducing the risk of local recurrence.

After oncoplastic surgery, boost planning becomes more complex due to the difficulty in anatomically identifying the original tumor bed.

Correct intraoperative marking with metallic clips plays an essential role in this context.

Some authors suggest caution when administering extensive boosts after major glandular remodeling due to the potential negative aesthetic impact, including:
• Localized fibrosis;
• Breast retraction;
• Late asymmetry;
• Changes in texture.

The decision should be individualized according to age, margins, tumor subtype, and risk factors

for local recurrence.

Postoperative Radiological Changes

Oncoplastic surgery produces complex radiological changes that may make interpretation of follow-up imaging more difficult.

Common findings include:

- Areas of fibrosis;
- Fat necrosis;
- Architectural distortion;
- Benign calcifications;
- Glandular asymmetries.

These changes may mimic tumor recurrence, making prior knowledge of the surgical technique used important.

Detailed surgical documentation and communication between the breast surgeon and radiologist significantly assist in the appropriate interpretation of postoperative imaging.

Toxicity and Aesthetic Outcome

The interaction between oncoplastic surgery and radiotherapy directly influences late cosmetic outcomes.

The main radiotherapy-related effects include:

- Fibrosis;
- Scar retraction;
- Edema;
- Pigmentary changes;
- Telangiectasias;
- Progressive asymmetry.

However, studies have demonstrated that immediate breast remodeling frequently reduces late deformities when compared with conventional breast-conserving surgery without reconstruction.

Adequate redistribution of breast tissue may minimize localized retractions induced by radiotherapy.

Importance of the Multidisciplinary Approach

The multidisciplinary approach represents one of the fundamental pillars of modern breast cancer treatment and plays an even more relevant role in oncoplastic surgery. The technical complexity of breast preservation combined with reconstructive remodeling requires continuous integration among different medical specialties, allowing individualized treatment planning, greater oncological safety, and better aesthetic and functional outcomes.

Oncoplastic surgery goes beyond the boundaries of traditional breast-conserving surgery by combining principles of breast surgery, plastic surgery, radiology, pathology, medical oncology, and radiation oncology. Thus, adequate treatment depends on effective communication among all professionals involved.

Several international consensus statements emphasize that multidisciplinary integration is associated with fewer treatment failures, better radiotherapy planning, a reduced need for reoperations, and greater patient satisfaction.[6,7]

Integration Among Specialties

The appropriate management of oncoplastic breast-conserving surgery depends on coordinated collaboration among different specialists.

Breast Surgeon

The breast surgeon plays a central role in the oncological planning of surgery and is responsible for clinical assessment, defining tumor resection, disease staging, and choosing the breast-conserving strategy.

In addition, the breast surgeon should have knowledge of oncoplastic techniques in order to integrate oncological safety and aesthetic outcomes.

Radiation Oncologist

The radiation oncologist plays an essential role in planning adjuvant radiotherapy after oncoplastic surgery.

Glandular remodeling may make identification of the tumor bed more difficult, making communication regarding the following essential:

- Technique used;
- Tumor location;
- Resected volume;
- Clip placement;
- Glandular redistribution.

Adequate delineation of the tumor bed is essential for administration of the radiotherapy "boost."

Radiologist

The radiologist participates in both the diagnostic phase and postoperative follow-up.

The radiologist's functions include:

- Preoperative localization of the lesion;
- Assessment of tumor extent;
- Identification of multifocality;
- Localization of non-palpable lesions;
- Interpretation of postoperative changes.

After oncoplastic surgery, imaging examinations become more complex due to the presence of fibrosis, fat necrosis, and architectural distortions.

Pathologist

The pathologist plays a critical role in the assessment of surgical margins and pathological evaluation of the surgical specimen.

Adequate anatomical orientation of the specimen is essential for:

- Identification of involved margins;
- Radiological correlation;
- Planning of possible reinterventions.

Medical Oncologist

The medical oncologist is involved in systemic treatment planning, including:

• Chemotherapy;
• Hormone therapy;
• Targeted therapies;
• Immunotherapy.

Tumor response to neoadjuvant treatment may significantly modify the surgical strategy and expand the possibilities of oncoplastic breast-conserving surgery.

Surgical Report

The operative report is of fundamental importance in oncoplastic surgery and should contain a detailed description of the technique employed.

The minimum recommended information includes:

• Oncoplastic technique used;
• Tumor location;
• Estimated resection volume;
• Anatomical orientation of the specimen;
• Clip placement;
• Type of glandular remodeling performed;
• Pedicle used;
• Contralateral symmetrization;
• Presence of flaps.

These data are essential for the radiation oncologist, radiologist, and follow-up team.

Preoperative and postoperative photographic documentation is also of increasing relevance for aesthetic assessment and longitudinal follow-up.

Complications

Complications of oncoplastic surgery can be divided into early and late complications. Although most procedures have a good safety profile, greater technical complexity may increase certain surgical risks compared with conventional breast-conserving surgery.

Complication rates vary according to:

• Technique used;
• Extent of resection;
• Breast volume;
• Comorbidities;
• Experience of the surgical team.

Early Complications

Early complications generally occur within the first few weeks after the procedure.

Seroma

Seroma is one of the most frequent complications, particularly after extensive glandular dissection and the use of flaps.

It may cause:

• Discomfort;

• Secondary infection;
• Delayed wound healing.

Hematoma

Hematoma may compromise flap vascularization and increase the risk of tissue necrosis.
Large hematomas may require surgical reintervention.

Infection

Postoperative infection may compromise the aesthetic outcome and delay the initiation of adjuvant radiotherapy or chemotherapy.
Patients with obesity, diabetes, and those who smoke have a higher risk of infection.

Dehiscence

Wound dehiscence occurs mainly in areas of greater scar tension, particularly at "inverted-T" junctions.

Fat Necrosis

Fat necrosis results from vascular compromise of adipose tissue and may present as:
• Palpable nodules;
• Induration;
• Calcifications;
• Radiological changes.
It may mimic tumor recurrence on imaging examinations.

Nipple-Areola Complex (NAC) Necrosis

NAC necrosis represents one of the most feared complications of therapeutic mammoplasties.
The main risk factors include:
• Smoking;
• Obesity;
• Long pedicles;
• Extensive resections;
• Diabetes.

Late Complications

Late complications are generally related to healing and the effects of radiotherapy.

Fibrosis

Fibrosis may cause breast induration and progressive retraction.

Asymmetry

Even after initial symmetrization, radiotherapy-induced changes may result in progressive asymmetry over time.

Scar Retraction

Scar retraction may significantly compromise breast contour and the position of the NAC.

Post-Radiotherapy Changes
Late effects of radiotherapy include:
• Edema;
• Fibrosis;
• Telangiectasias;
• Pigmentary changes;
• Tissue contraction.

Fat Necrosis
Late fat necrosis may present years after the procedure and is frequently mistaken for tumor recurrence.

Risk Factors for Complications
Several factors increase the incidence of complications in oncoplastic surgery.

Smoking
Smoking compromises microcirculation and increases the risk of:
• Necrosis;
• Infection;
• Dehiscence;
• Vascular compromise of the NAC.

Obesity
Patients with obesity have a higher risk of:
• Seroma;
• Infection;
• Fat necrosis;
• Anesthetic complications.

Diabetes
Diabetes is associated with impaired wound healing and a higher risk of infection.

Radiotherapy
Radiotherapy increases the risk of fibrosis, retraction, and late aesthetic changes.

Extensive Resections
Large resections increase tissue tension and the risk of deformities.

Aesthetic Outcomes and Quality of Life
Oncoplastic surgery has brought about an important change in the concept of therapeutic success in breast cancer. Currently, aesthetic and psychosocial outcomes are considered an integral part of oncological treatment.

Several studies using validated instruments, such as the BREAST-Q, demonstrate high levels of satisfaction after oncoplastic surgery.

Psychosocial Benefits

The main benefits include:

- Better body image;
- Greater patient satisfaction;
- Reduced psychological impact;
- Preservation of femininity;
- Better sexual quality of life;
- Better social reintegration.

Patients undergoing oncoplastic surgery frequently report a lower perception of bodily mutilation compared with mastectomy and conventional breast-conserving surgery.

Aesthetic Satisfaction

Immediate breast remodeling allows:

- Better symmetry;
- Preservation of breast contour;
- Reduction of deformities;
- Better positioning of the NAC.

Meta-analyses demonstrate high levels of aesthetic satisfaction and better quality of life compared with conventional breast-conserving surgery.

Future Perspectives

Oncoplastic surgery continues to evolve rapidly, keeping pace with technological advances and trends toward individualized treatment.

Image-Guided Surgery

The integration of intraoperative imaging and three-dimensional surgical planning is expected to increase the precision of resections.

Minimally Invasive Techniques

Endoscopic approaches and smaller incisions are being studied to reduce morbidity and improve aesthetic outcomes.

Biomaterials

The use of acellular dermal matrices and biomaterials may expand reconstructive options for complex defects.

Adjunctive Fat Grafting

Fat grafting has been widely used to correct irregularities, improve the quality of irradiated tissue, and provide aesthetic refinement.

Robotic Surgery

The application of robotic surgery in breast reconstruction is still in its early stages but has the potential to reduce scarring and morbidity.

Artificial Intelligence

Artificial intelligence may contribute in the future to:

- Objective assessment of symmetry;
- Surgical planning;
- Prediction of complications;
- Automated aesthetic analysis.

Surgical De-escalation

The contemporary trend in breast oncology prioritizes less invasive and more individualized treatments.

Increasing rates of pathological complete response after neoadjuvant therapies may directly influence the future of breast-conserving resections.

CONCLUSION

Oncoplastic surgery has revolutionized the breast-conserving treatment of breast cancer by allowing wider resections without significantly compromising aesthetic outcomes. The integration of oncological principles and reconstructive techniques has expanded the therapeutic possibilities of breast preservation, providing better psychosocial outcomes and high levels of patient satisfaction.

Current evidence demonstrates that oncoplastic surgery maintains high standards of oncological safety, with local recurrence and survival rates equivalent to those of conventional breast-conserving surgery, in addition to lower rates of deformity and reoperations.[1-5]

Mastery of oncoplastic techniques has become an essential skill for the modern breast surgeon. However, the success of this approach depends directly on adequate preoperative planning, careful patient selection, and multidisciplinary integration among breast surgery, plastic surgery, radiology, pathology, medical oncology, and radiation oncology.

Thus, oncoplastic surgery has become established as one of the fundamental pillars of contemporary breast cancer treatment, representing an important advance in the pursuit of increasingly effective, individualized therapies centered on the patient's quality of life.[10-16]

REFERENCES

1. Fisher B, Anderson S, Bryant J, et al. Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation. New England Journal of Medicine. 2002;347(16):1233-1241.

2. Veronesi U, Cascinelli N, Mariani L, et al. Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. New England Journal of Medicine. 2002;347(16):1227-Urban C, Lima RS, Schunemann E, et al. Oncoplastic principles in breast conserving surgery. Breast. 2011;20(Suppl 3):S92-S95.

3. Silverstein MJ, Savalia N, Khan S, Ryan J. Extreme oncoplasty: breast conservation for patients who need mastectomy. Breast Journal. 2015;21(1):52-59.

4. Clough KB, Kaufman GJ, Nos C, Buccimazza I, Sarfati IM. Improving breast cancer surgery: a classification and quadrant per quadrant atlas for oncoplastic surgery. Annals of Surgical Oncology. 2010;17(5):1375-1391.

5. Crown A, et al. Patient-reported outcomes after oncoplastic breast surgery. Breast Journal. 2019;25(1):85-90.

6. De Lorenzi F, Hubner G, Rotmensz N, et al. Oncological results of oncoplastic breast-conserving surgery: long term follow-up of a large series at a single institution. Breast Cancer Res Treat. 2016;160(3):485-491.

7. Losken A, Dugal CS, Styblo TM, Carlson GW. A meta-analysis comparing breast conservation therapy alone to the oncoplastic technique. Annals of Plastic Surgery. 2014;72(2):145-149.

8. Fitoussi AD, Berry MG, Fama F, et al. Oncoplastic breast surgery for cancer: analysis of 540 consecutive cases. Plastic and Reconstructive Surgery. 2010;125(2):454-462.

9. Weber WP, Soysal SD, El-Tamer M, et al. First international consensus conference on standardization of oncoplastic breast conserving surgery. Breast Cancer Res Treat. 2017;165(1):139-149.

10. Moran MS, Schnitt SJ, Giuliano AE, et al. Society of Surgical Oncology–American Society for Radiation Oncology consensus guideline on margins for breast-conserving surgery. Ann Surg Oncol. 2014;21(3):704-716.

11. Early Breast Cancer Trialists' Collaborative Group (EBCTCG). Effect of radiotherapy after breast-conserving surgery on 10-year recurrence and 15-year breast cancer death. Lancet. 2011;378(9804):1707-1716.

12. Mansfield L, Agrawal A, Cutress RI. Oncoplastic breast conserving surgery. Gland Surg. 2013;2(3):158-162.

13. Heeg E, et al. Rates of re-excision and conversion to mastectomy after breast-conserving surgery with or without oncoplastic surgery. Br J Surg. 2020.

14. Association of Breast Surgery. Oncoplastic Breast Surgery Guidelines. 2021.

15. Associação Brasileira de Mastologia. Consenso Brasileiro de Cirurgia Oncoplástica. São Paulo: SBM; última edição.

16. Al-Ghazal SK, Fallowfield L, Blamey RW. Comparison of psychological aspects and patient satisfaction following breast conserving surgery, simple mastectomy and breast reconstruction. European Journal of Cancer. 2000;36(15):1938-1943.

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EDITORIAL AND REVIEW

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