Chapter

Oncoplastic Breast Conservation: A Standard of Care in Modern Breast Cancer Surgical Management

Ana Car Peterko

Abstract

Within the multimodal treatment, the extent of surgery for early-stage breast cancer treatment may be safely de-escalated. This strategy is associated with less morbidity, therefore significant improvements in quality of life (QoL). Nevertheless, conventional, ablative-only breast conservative surgery (BCS) has several limitations considering breast aesthetics and may impact QoL just opposite than anticipated. The concept of oncoplastic breast conservation emerged at the end of the last century intending to overcome these limitations. Although the primary goal remains oncological safe cancer resection, the enhanced aesthetic outcomes, achieved with this approach, significantly contribute to higher patient satisfaction. The author believes that mastectomy should no longer be offered as an equivalent treatment option for early-stage breast cancer patients with low-volume breast disease, irrespective of the availability of postmastectomy breast reconstruction. Moreover, with the opportunities of oncoplastic breast conservative surgery, the technical feasibility of breast conservation should not represent an issue even in a higher stage of the disease. Clinical decision on the type of oncoplastic procedure is mainly based upon the anticipated percentage of breast volume loss and the residual breast volume, as well as the availability of additional donor sites, patients' preference, and surgeons' skills.

Keywords: breast cancer, surgery, mastectomy, breast conservation, oncoplastic, quality of life

1. Introduction

Breast cancer was the most common malignant disease in the general population worldwide, contributing 12.5% of the total number of new cases and 25.8% of new cases in females diagnosed in 2020 [1]. The average woman's lifetime risk of breast cancer diagnosis is as high as 12–13%, that is, statistically, one in every eight women will be diagnosed with breast cancer during her life [2].

Due to population screening programmes and increased breast awareness in the developed world, breast cancer is nowadays detected predominantly (80%) in the preclinical and early stages of the disease. With the multidisciplinary management and the modern multimodal treatments, in this subgroup of patients, the oncological

outcomes are excellent, with a 5-year overall survival (OS) rate reaching over 95%. Moreover, the cumulative 10-year OS rate of 70–80% has been reported as well [3].

In addition to conventional oncologic outcomes, quality of life (QoL) has emerged as an important outcome measure and has been recently established in breast cancer management evaluation. The world's most prevalent cancer, with 2.3 million newly diagnosed patients yearly and 7.8 million new breast cancer survivors every 5 years [4], clearly justifies the QoL evaluation in all breast cancer management trials.

The ultimate goals of modern breast cancer surgery are optimal local and regional control of the disease, associated with minimal morbidity and enhanced aesthetic outcomes.

2. Surgical management of early-stage breast cancer

Until the seventies, mutilating procedures in the breast and axilla, intended for disease eradication, were the only available surgical options in breast cancer treatment, irrespective of the stage of the disease. Better insights into breast cancer biology, as well as a better understanding of the natural course of the disease, have contributed to substantial changes in surgical management over the last five decades. Clinical trials, initiated by Veronesi and Fisher [5–7], have demonstrated that breast conservative surgery, accompanied by adjuvant breast irradiation, is not an inferior option for the early-stage (T1-T2) breast cancer treatment. Moreover, the survival outcomes in several, more recent, population-based studies [8–13] favour a conservative approach (**Table 1**).

As no benefit has not ever been associated with the more extensive procedures, breast surgery has been de-escalated to the more conservative options. Several synonyms for breast conservative surgery (BCS) are present in the literature: partial mastectomy, quadrantectomy, segmentectomy and lumpectomy. Although there are slight differences among the original definitions, nowadays the term represents

Reference	Number of patients included	Years of follow up	Endpoint(s)	Results
Milan trial [5, 6]	701	20	OS (Mx vs. BCS)	41% vs. 42%
NSABP B-06 [7]	1843	20	OS (Mx vs. BCS)	47% vs. 46%
Norwegian population register [8, 9]	13,015	10	BCSS (Mx vs. BCS) OS (Mx vs. BCS)	82% vs. 93% 64% vs. 86%
Indian hospital-based registers [10]	7609	5	OS (Mx vs. BCS) Stage I Stage II Stage III	99% vs. 91% 86% vs. 94% 69% vs. 87%
SEER [11]	132,149	10	BCSS (Mx vs. BCS)	90% vs. 94%
Danish population register [12]	58,331	10	OS (Mx vs. BCS) vs. BCS and Mx	57% vs. 82% vs. 74%
Dutch population register [13]	129,692	6 12	OS (Mx vs. BCS) OS (Mx vs. BCS)	80% vs. 91% 72% vs. 52%

Table 1.
Overall survival (OS) and/or breast cancer specific survival (BCSS) in relation to surgical treatment: Mastectomy (Mx) vs. breast conservative surgery (BCS).

a breast tumour resection with appropriate histological margins, that is, 'no ink on tumour' for invasive breast cancer and a minimum of 2 mm of benign breast tissue surrounding the *in situ* disease [14, 15]. The goal of this treatment de-escalation strategy is QoL improvement, related to breast preservation. Nevertheless, the conventional, ablative-only approach in BCS has several limitations considering breast shape and symmetry, that is, breast aesthetics, and may impact QoL just opposite than anticipated [16].

The breast resection volume and the lesion location within the breast are major determinants of the aesthetic outcome following conventional BCS. Even in the early stage of the disease (T1-T2), a 30% risk of breast deformity is reported in the literature. Resection volume over 15–20% of breast volume in outer quadrants and over 10% in medial or central quadrants, without partial breast reconstruction, may already result in some degree of breast deformity [17, 18]. In addition, natural (preoperative) breast shape, degree of ptosis and breast glandular density impact the aesthetic outcome as well. According to available literature data [19], four degrees of breast deformity have been reported following BCS, from a mild NAC retraction to the severe distortion of the entire breast.

The oncoplastic approach emerged at the end of the last century with intention of overcoming the limitations of conventional BCS. Following oncoplastic procedures, breast shape and symmetry remain preserved, although the breast volume may be reduced. Moreover, breast aesthetics can be improved with this type of cancer surgery.

The term 'oncoplastic' was first mentioned by German surgeon Audretsch in 1993 [20]. Merged from the Greek words 'onco' (tumour) and 'plastic' (shaping), it signifies reshaping the breast after the tumour resection. Although the primary goal remains oncological safe cancer resection, the enhanced aesthetic outcomes, achieved within this approach, contribute to the improvements of the QoL among the survivors. The concept was therefore easily accepted worldwide and is further developing into a new surgical discipline.

Superior aesthetic outcomes are not the only advantage of the oncoplastic approach. In a meta-analysis of 8659 patients from 61 studies [16], specimen weight, re-excision rate, local recurrence rate and patient satisfaction were compared between conventional and oncoplastic BCS. All analysed endpoints favour the oncoplastic approach, indicating that higher rates of BCS with lower re-excision rates can be achieved in addition to lower local recurrence rates and higher patient satisfaction. It is interesting to consider that the same endpoints are proposed by the EUSOMA working group [21] for quality indicators (QIs) in the early-stage breast cancer surgical management evaluation. Accordingly, higher rates of breast conservation for low volume *in situ* and invasive breast disease, as well as lower rates of re-excision following BCS, suggest a higher quality of surgical management. In other words, the mastectomy rate of over 30%, in this subgroup of patients, indicates the poor quality of surgical management. Additional arguments that further support the latest observation are available in the scientific literature as well. Potter reports significantly higher rates of complications, re-operations and re-admissions to hospital in the oncoplastic mastectomy group as compared to oncoplastic breast conservation, in patients with tumour size less than 3 cm [22]. In Chands' QoL analysis, all aspects of the validated questionnaire (breast appearance, physical, emotional and sexual well-being) were better in the oncoplastic BCS group, when compared to any type of postmastectomy reconstruction [23]. Finally, in the Dutch cost-utility study, oncoplastic BCS is reported as more cost-effective than mastectomy followed by implant-based or autologous breast reconstruction [24].

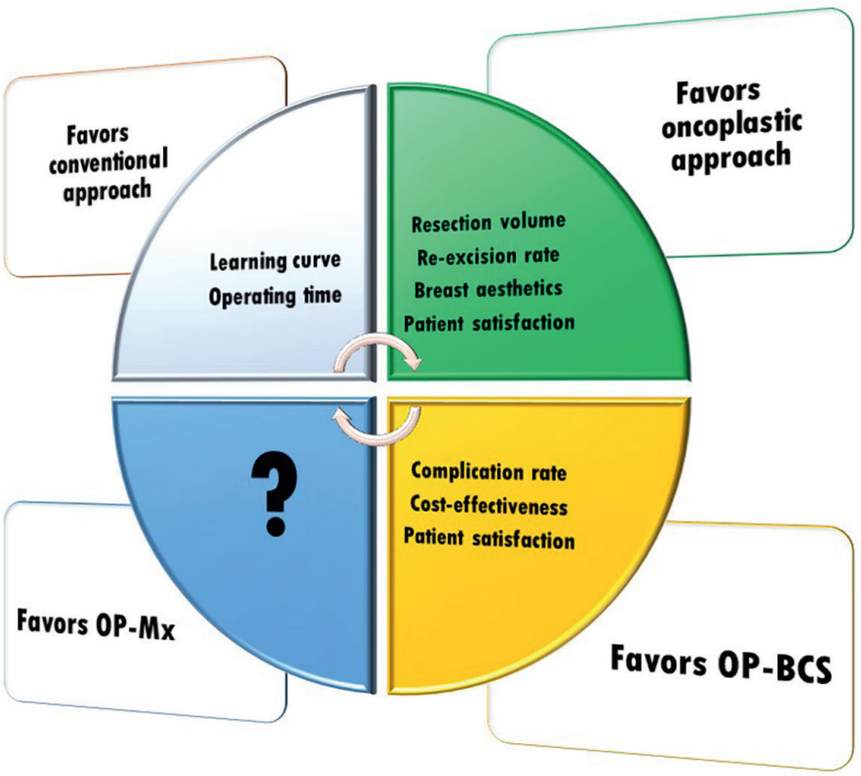

Figure 1.
Surgical options in early-stage breast cancer treatment. OP-BCS = oncoplastic breast conservative surgery, OP-Mx = oncoplastic mastectomy.

Considering all the above-mentioned arguments favouring oncoplastic BCS, the author believes that mastectomy should no longer be offered as a comparable treatment option for a low-volume breast disease unless there is a strong oncologic contraindication for breast conservation (**Figure 1**).

With all available oncoplastic techniques, the technical feasibility of surgery should not represent an issue in this stage of the disease. Moreover, the oncoplastic approach offers the opportunity for breast preservation even in selected patients with locally advanced disease [25].

3. Surgical management of locally advanced breast cancer (LABC)

Irrespective of screening programmes, 15% of all breast cancer is still diagnosed with the locally advanced stage of the disease (T3-4 and/or N2-3). However, the reported 5-year OS is still 70–80%. Therefore, QoL, as an important outcome measure in the management evaluation, cannot be ignored either in this group of patients.

In the modern multimodal approach, neoadjuvant systemic treatment is the first-line option for these patients. According to all relevant treatment recommendation guidelines, neoadjuvant chemotherapy (NAC) should be offered to all aggressive breast cancer phenotypes (TNBC and HER2 enriched) with a tumour size of over 2 cm or/and axillary lymph node involvement. From the surgical point of view, the major benefit of this approach is tumour downsizing, allowing a higher rate of conservative procedures in the breast and axilla. However, the high rate of treatment response following NAC is still not accompanied by the equivalent increase in BCS in

everyday clinical practice; that is, the surgical overtreatment is consistently reported in the literature [26, 27].

According to evidence-based practice guidelines, as well as expert consensus guidelines, response-adjusted surgery is the recommended option following NAC; that is, only the residual disease in the breast should be removed following treatment response. For the non-responders, those with a poor response or with scattered patterns of response, the oncoplastic approach has broadened the possibilities for breast conservation. However, care should be taken in those patients with the multifocal residual pattern, lymphatic vascular invasion, residual T size over 2 cm, and extensive nodal involvement following NAC, as a higher risk of local and regional recurrence was reported for the subgroup of patients with multiple above-mentioned factors detected [28].

Nevertheless, extensive *in situ* disease, as well as extensive invasive breast cancer (T3), no longer represents an absolute contraindication for breast conservation. The results reported by Silverstein and Libson [25, 29] indicate that extreme oncoplastic breast conservation is an oncological safe approach for patients with high-volume breast disease. In addition, it allows safe and aesthetically pleasing breast preservation in patients with multifocal and multicentric diseases [30–33]. However, the decision on the type of surgical procedure for the LABC patient should be always made in a multidisciplinary fashion, considering all aspects of multimodal treatment, rather than the technical feasibility of surgery exclusively.

4. Relative contraindications for breast-conserving surgery

Although good aesthetic results and a large volume of resection can be achieved with oncoplastic BCS, mastectomy may still be required in patients with the multicentric disease when appropriate resection cannot be achieved in a single resection volume, especially for those patients with a higher risk of local relapse, in whom irradiation boost to tumour bed might be required for optimal oncologic outcomes.

Hereditary breast cancer with a proven high-risk genetic mutation, as well as strong family history without a proven high-risk mutation, but with a calculated lifetime risk of contralateral breast cancer of over 30%, may also represent a relative contraindication for BSC. For these patients, a bilateral mastectomy may be recommended, although the evidence of survival benefit is reported only after a long-term follow-up (>15 years) [34, 35]. In addition to young age, patients diagnosed with less aggressive tumour subtypes might as well benefit from the radical bilateral procedure [36]. When considering the risk of local relapse in patients with proven high-risk mutations, the results of scientific reports are unclear. Although there are literature data favouring mastectomy, other studies did not confirm any benefit for local control management in these patients [37].

Another issue requiring clarification in surgical management decision-making is ipsilateral breast recurrence following previous BCS and whole breast irradiation. Although better oncological outcomes following radical procedures have not been confirmed by the results of any randomised control trials, mastectomy is the most often recommended clinical practice for this condition. Nevertheless, several non-randomised clinical trials have reported non-inferiority of BCS for the selected subgroup of patients, even for those cases in which re-irradiation was omitted [38, 39].

In conclusion, when deciding on the type of breast surgery for LABC, multicentric, hereditary and familial breast cancer, as well as for ipsilateral recurrence, the

author recommends a multidisciplinary and highly personalised approach to every case. The scientific evidence is not yet strong enough to support standardisation for optimal management in these patients. Randomised clinical trials are needed for a better understanding of these cases, although the low frequency of the condition and ethical issues involved represent obstacles to the appropriate study design.

5. Absolute contraindications for breast-conserving surgery

Only a few situations represent the absolute contraindication to BCS: inflammatory breast cancer, irrespective of NAC treatment response, inability to obtain adequate resection margins due to diffuse breast disease, and inability to deliver adjuvant breast irradiation (lack of required facilities or patient comorbidities that prevent safe irradiation delivery). Although rare nowadays, in these cases mastectomy is considered mandatory, with or without immediate or delayed breast reconstruction.

Patients' desire for radical surgery is another issue that requires consideration. It is often driven by patients' knowledge gaps and subsequent fear of disease recurrence. The surgeon's role in modifying patients' decisions is tremendous. Most of the patients can be reassured easily with the appropriate information concerning both procedures, as well as their impact on oncologic outcomes and QoL [22, 23]. A decision for mastectomy should never reflect the surgeon's desire to avoid complex oncoplastic surgery. The optimal treatment strategy must be offered to every patient and ignorance may not be an excuse for suboptimal management.

Relative and absolute contraindications for BCS are summarised in **Table 2**.

6. Oncoplastic techniques in breast conservative surgery

For academic purposes, the techniques of partial breast reconstruction following tumour resection can be divided into two major groups: breast volume displacement and breast volume replacement (**Figure 2**). The basic difference is in the donor area utilised for partial breast reconstruction. The resected volume can be substituted by displacement of the remaining breast parenchyma, or replaced with fat tissue harvested adjacent to the breast.

Volume displacement techniques may further be categorised into level I (simple breast tissue advancement) and level II procedures (breast tissue rearrangement); however, due to variable definitions in the literature, certain techniques can be

Relative contraindications for BCS	Absolute contraindications for BCS
Locally advanced breast cancer	
Multicentric disease	Inflammatory breast cancer
Hereditary breast cancer	Diffuse breast disease
Familial breast cancer	Adjuvant breast irradiation cannot be delivered
Ipsilateral breast cancer recurrence	
Patient opting for mastectomy?	

Table 2.
Relative and absolute contraindications for breast conserving surgery in breast cancer management.

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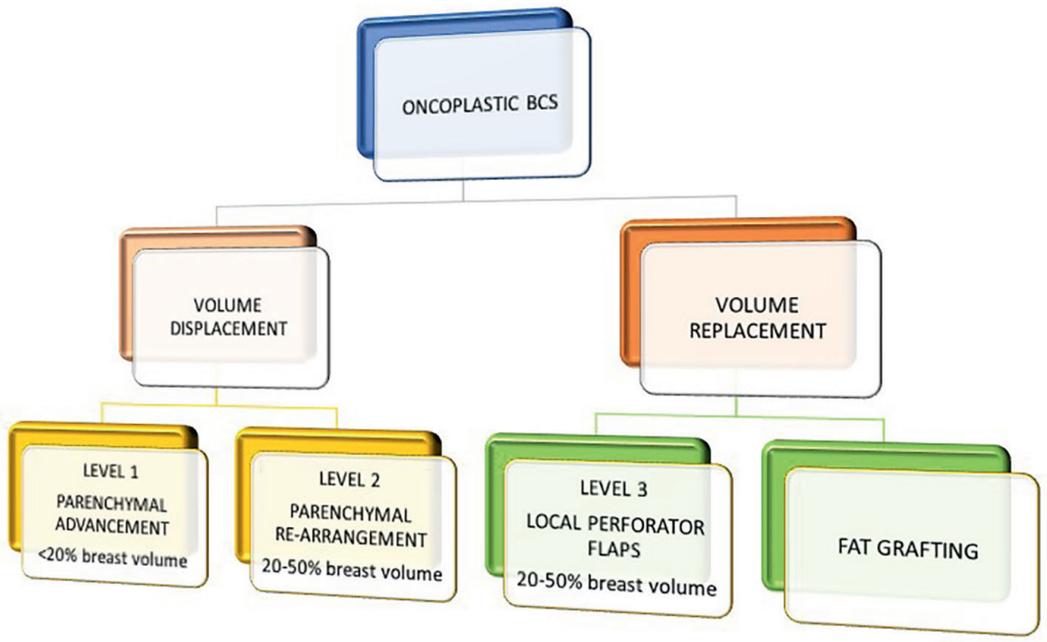

Figure 2.
Oncoplastic techniques in breast conserving surgery.

categorised in both groups. Although basic concepts originate from reconstructive surgery (advancement flaps) and aesthetic breast surgery (mastopexy and breast reduction), the adopted procedures were significantly modified and enriched with new techniques, designed for cancer surgery. Different oncoplastic breast surgery atlas recommendations, proposed by different authors, suggest a lack of standardisation in the field. Nevertheless, a multitude of techniques enables a personalised surgical approach for each patient.

Volume replacement techniques, local perforator flaps (level III) and fat grafting, both adopted from reconstructive surgery, have recently emerged as popular alternatives in partial breast reconstruction.

Clinical decision on the type of oncoplastic procedure is mainly based upon the anticipated percentage of breast volume loss and the residual breast volume [40], as well as the availability of additional donor sites, patients' preference and surgeons' skills.

Profound knowledge of breast anatomy is required for optimal performance for both ablative and reconstructive parts of all breast oncoplastic procedures. Compliance with the proposed oncoplastic planes of dissection, as well as respecting the breast as an aesthetic unit (shape, nipple position and symmetry with the contralateral breast), in addition to oncological safe tumour resection, is mandatory for the successful outcome of the oncoplastic surgery. Otherwise, it may result in higher complication rates (bleeding, skin and NAC necrosis, fat necrosis, infection), higher re-excision rates, and higher rates of local recurrence and disease progression. However, detailed breast anatomy and a description of surgical techniques are both beyond the scope of this chapter.

6.1 Level 1 volume displacement (parenchymal advancement)

Every oncoplastic breast surgery starts with skin incision planning. If the skin overlying the tumour is closed or involved, the skin incision is determined by the

tumour position. However, whenever oncology is safe, the preferred approach is the skin incision hidden in the inframammary fold (IMF), peri-areolar region or lateral mammary fold, accompanied by retro-glandular or subcutaneous access to the breast lesion and oncoplastic lumpectomy.

From the surgical perspective, oncoplastic level 1 procedures are technically the least demanding with a fast learning curve and wide applicability. It represents the optimal surgical approach for the majority of early-stage breast cancer patients. The best results are achieved for resections not exceeding 20% of the breast volume, ideally, in small- to medium-size, non-ptotic, firm, dense (BIRADS C-D) breasts. The basic concept of level 1 partial breast reconstruction relays upon single- or dual-layer mobilisation of the breast parenchyma surrounding the resected area and its closure by simple parenchymal advancement.

Nipple and areola complex (NAC) repositioning into a new breast centre may be required following extensive parenchymal advancement. However, if NAC pedicles and significant tissue rearrangement are involved, it would be more appropriate to categorise it as a level 2 procedure (**Figure 3**).

6.2 Level 2 volume displacement (parenchymal rearrangement)

Except for the NAC pedicle formation, significantly extensive breast tissue rearrangement is involved in level 2 procedures. Consequently, the procedures are more complex, as compared to level 1, and a longer learning curve is required. A resection volume of over 20% of breast volume is an indication for the level 2 procedure. However, only selected patients, with ptotic, medium or large volume, fatty (BIRADS A-B) breasts are appropriate candidates for level 2 oncoplastic breast conservation.

Although mastopexy and reduction mammoplasty represent the origins of the level 2 procedures, the techniques have been significantly modified for cancer surgery. If the skin is not involved, the type of the skin incision (round block, vertical scar, inverted T) is determined by surgeons' preference, breast volume and the degree of breast ptosis. Subcutaneous lumpectomy for any tumour location can be performed

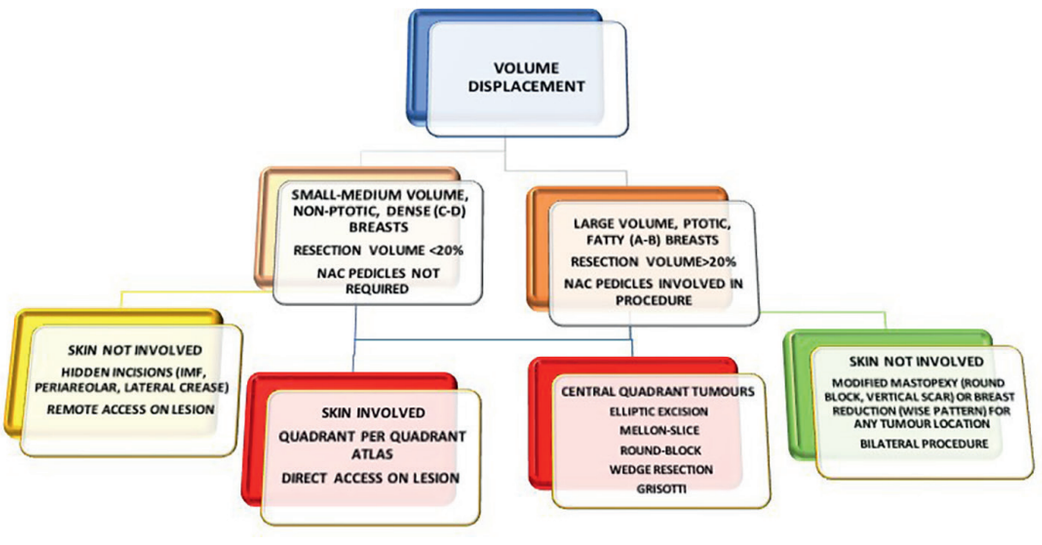

Figure 3.
Oncoplastic volume displacement level 1 and level 2.

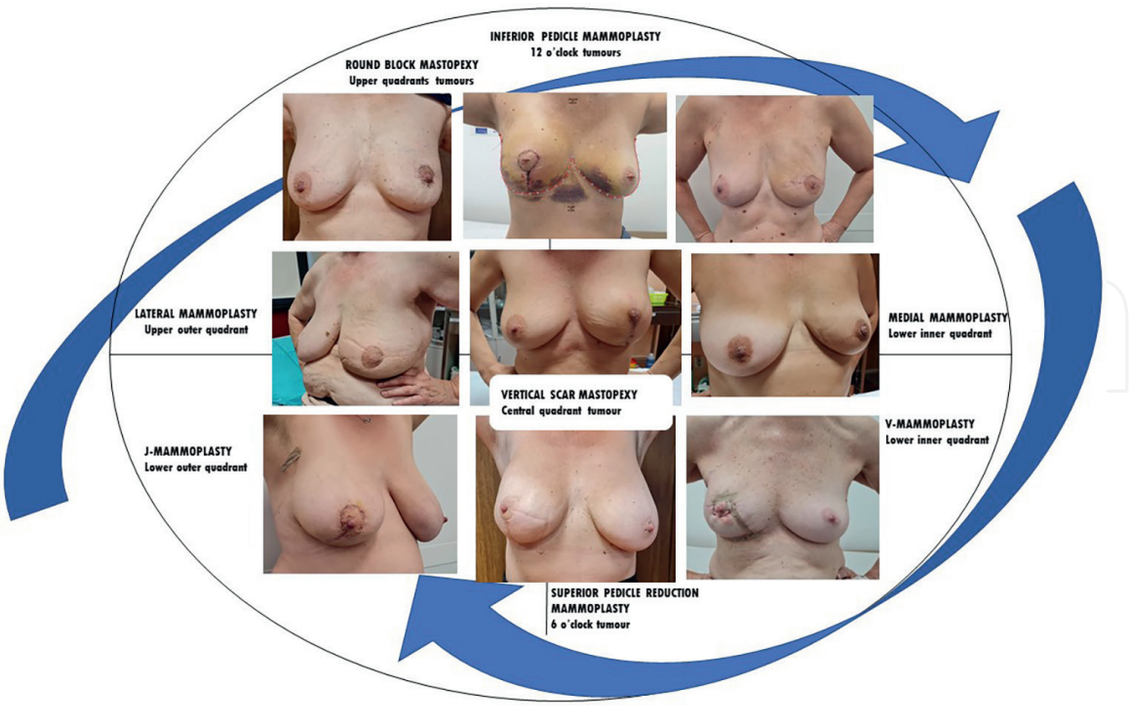

Figure 4.
Quadrant per quadrant atlas of oncoplastic volume displacement techniques.

through any of the above-proposed types of skin incision. However, the choice of NAC pedicle, parenchymal resection and rearrangement are influenced by the tumour location within the breast [19]. Nevertheless, if the overlying breast skin is involved, the tumour location determines the skin incision and the technique modification accordingly. For these situations, a quadrant-per-quadrant atlas of oncoplastic procedures has been proposed [41] as follows: lateral mammoplasty for the upper outer quadrant, J/L mammoplasty for the lower outer quadrant, V mammoplasty for the lower inner quadrant, batwing mastopexy for the upper inner quadrant, and superior/inferior pedicle mammoplasty for 12 and 6 o clock tumours (**Figure 4**).

For small-volume tumours in the small-to-medium volume, firm (dense), non-ptotic breasts, good results can be achieved in a single oncoplastic procedure. However, if a larger resection volume is required or the procedure is performed in hypertrophic, fatty and/or severe ptotic breasts, symmetry can only be achieved with an additional surgical procedure in the contralateral healthy breast. Following level 2 oncoplastic surgery, a symmetrisation procedure for the contralateral breast is usually required. Aesthetically pleasing results (good symmetry) can be accomplished with an equal procedure in the healthy breast at the time of cancer surgery or following adjuvant oncologic treatment(s) and an additional 6–12-month period required for breast stabilisation.

6.3 Oncoplastic breast conservation for central quadrant tumours

For central quadrant tumours, several procedures have been proposed: elliptic horizontal/vertical excision of the central portion of the breast, melon slice, round block and wedge resection. The choice of the optimal procedure depends on the breast volume and shape, as well as the breast volume required for oncological safe resection. The goal is to maintain the maximum projection site in the centre of the breast.

The proposed methods for NAC reconstruction are local skin flaps, contralateral NAC (grafting), NAC tattooing and external NAC prosthesis.

6.4 Level 3: volume replacement (local perforator flaps in partial breast reconstruction)

Another reconstructive option following breast conservative surgery is volume replacement (level 3 oncoplastic breast conservative surgery). The technique is the ideal choice if a large resection volume is required in a small volume breast and a patient desires to avoid mastectomy. It is also a good alternative for a large resection volume in a large volume breast, but in a patient wishing to avoid additional procedures for symmetry in a contralateral healthy breast. Moreover, it is a useful option for the correction of deformity following unsuccessful previous BCS.

The flaps utilised in partial breast reconstruction can be harvested as random or perforator-based flaps. The irrigation of the flap is based on nearby perforator arteries: medial, anterior, and lateral intercostal arteries perforators (MICAP, AICAP, LICAP), lateral thoracic artery perforators (LTAP) and thoracodorsal artery perforators (TDAP). These adipo-cutaneous flaps may be designed in the epigastric area, just below to IMF or in the lateral thoracic region, connected to a lateral mammary crease, and therefore can be easily inserted in a breast defect following tumour resection (**Figure 5**). However, additional scars, donor site morbidity and a higher risk of

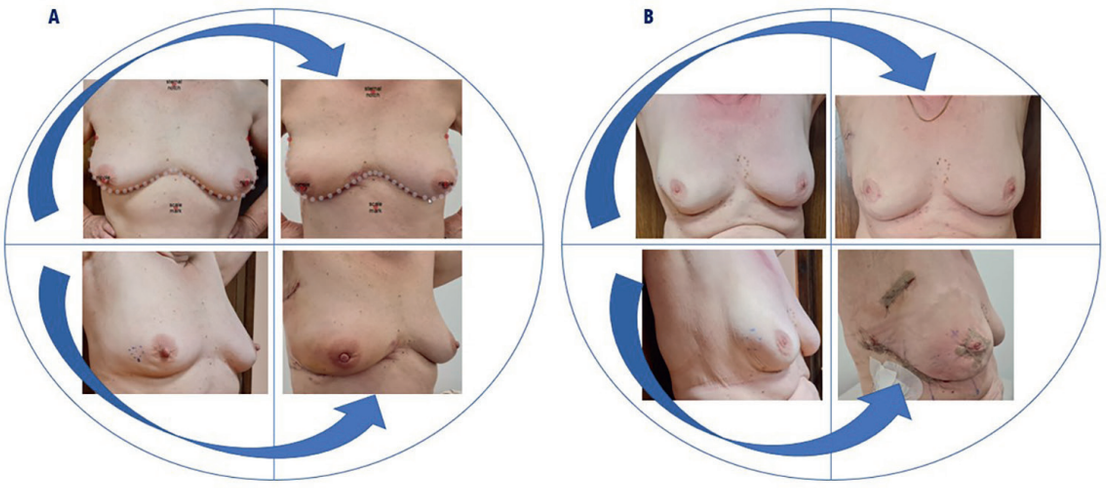

Figure 5.
Local perforator flaps for partial breast reconstruction harvested in a) epigastric region and b) lateral thoracic region.

complications associated with these techniques mandate additional surgical training, as well as appropriate patient selection. A detailed description of the techniques is available widely across the literature [42–46] and is beyond the scope of this chapter.

7. Conclusion

Modern breast cancer surgical management should consider QoL as an equally important treatment outcome as the traditional oncological endpoints.

Implementation of an oncoplastic breast conservative approach has significantly improved the QoL as compared to conventional BCS in early-stage breast cancer patients. Moreover, oncoplastic BCS has become a treatment option even for patients diagnosed in the locally advanced stage of the disease and irrespective of the tumour response to NAC. As compared to oncoplastic mastectomy, it does not affect the oncological outcomes; however, fewer complications, better QoL and fewer expenses for the healthcare system have been reported for the oncoplastic BCS.

Oncoplastic breast surgery has emerged as a new concept, and it is developing into a new surgical discipline. Basic surgical training in general or plastic surgery is no longer an optimal level of education for the surgeons involved in breast cancer management. Additional theoretical and practical knowledge is highly recommended. In addition, for optimal margin assessment, appropriate irradiation dose delivery and patient follow-up after an oncoplastic procedure, all breast specialists within the modern oncoplastic breast multidisciplinary team should become familiar with the oncoplastic techniques as well.

Conflict of interest

The author declares no conflict of interest.

Author details

Ana Car Peterko
Department of General Surgery and Surgical Oncology, Clinical Hospital Centre Rijeka, Rijeka, Croatia

*Address all correspondence to: anacarpeterko@gmail.com

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