

Investigation into breast cancer and partial breast reconstruction: A review

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Abstract

Growing increasingly in South America, Africa and Asia, breast cancer is known as the dominant type of cancer in women. Different treatments are available for breast cancer, among which surgery is the most widely used, but researchers are trying to develop new strategies. One of the most prominent surgical methods is referred to as oncoplastic surgery, that helps to remove segments of malignant breast tissue. This type of surgery aims to obtain vast surgical margins, while the remaining tissue is rearranged so that the better cosmetic outcome is obtained. This review will investigate the breast cancer and then discuss partial breast reconstruction. Before outlining the procedures, the different types of partial breast reconstruction will be discussed. Finally, advantages and disadvantages will be outlined. MEDLINE database was used to conduct the search. The main terms used were 'Conservation Breast Surgery Reconstruction' AND 'Oncoplastic Surgery', 'Partial Mastectomy Reconstruction' AND 'Conservative Breast Surgery Reconstruction', 'oncoplastic' [All Fields], 'breast' AND 'surgery' OR 'surgery' operative', 'oncoplastic' ('breast'). The bibliographies of relevant papers were manually searched up to October 2018, but more recent voices are also included.

Key Words: Breast Cancer, Oncoplastic Surgery, Partial Breast Reconstruction.

Eur J Transl Myol 29 (2): 79-85, 2019

Breast cancer is known as the dominant type of cancer in women, about 232,000 cases are reported annually in the United States.^{1,2} Breast cancer constitutes 22.9% of all invasive cancers in women. Invasive breast cancer refers to a cancer which affects ducts, glands and other parts of the breast.³

Prevalence and Risk Factors

The incidence of breast cancers grows with increasing age. The Centers for Disease Control and Prevention reported that the age group 70-74 years is most vulnerable. According to the UK Cancer Research, approximately 54,900 cases of breast cancer are reported annually in the UK. Furthermore, it is the most common type of cancer in the UK, accounting for 15% of all new cases.⁴ Breast cancer is the most common invasive cancer in women worldwide, affecting 12% of women. Several risk factors for breast cancer are presented in Table 1.⁵

Benign breast disease

Non-invasive non-melanoma breast skin tumor is the most common benign disease, that it is easy to treat. Indeed it accounts to few deaths. Genetics, higher levels of hormones, obesity, dietary patterns and lack of breastfeeding are some of the main risk factors. Exposure to light pollution can increase the likelihood of breast cancer. Changes in hormone balances during normal, monthly menstrual cycles can lead to symptomatic breast changes for some women. Cysts are defined as tiny, benign, fluid-filled sacs that are problematic for women. Lump size may intensify the week before the menstrual period and lessen a week after. Some benign breast conditions include gynaecomastia, benign phyllodes tumor, breast pain, breast cysts, breast calcifications, Lobular neoplasia, sclerosing lesions of the breast, Mondor's disease, duct ectasia, intraductal papilloma, fibroadenoma, hyperplasia, intertrigo (rash under the

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Table 1. Risk factors of breast cancer

Risk factor	Explanation
Age	Older women are more likely to develop breast cancer.
Family History	Women with a history of breast cancer are more likely to develop breast cancer.
Genetics	Approximately 5% to 10% of breast cancers are attributed to hereditary factors.
History of Breast Cancer	Patients with breast cancer are more likely to develop a new cancer in the other breast or a different part of the same breast.
Certain Breast Changes	Several types of benign breast conditions may affect breast cancer risk.
Race/Ethnicity	White women are more likely to develop breast cancer than African American, Hispanic, and Asian women.
Smoking	Smoking is reported to increase the risk of developing breast cancer in younger, premenopausal women.
Diet	According to the reports, diet accounts for approximately 30% to 40% of all cancers.
Dense Breasts	According to the reports, dense breasts are 6 times more likely to develop cancer. This can complicate the detection of breast cancer.

breast), periductal mastitis, fat necrosis and atypical hyperplasia.⁶

Clinical Presentation of Breast Cancer

Some of the main symptoms include pain in breast or pain in the nipple area, new lump in the breast, thickening or swelling of part of the breast, nipple discharge other than breast milk, new lump in the breast or underarm, redness or flaky skin in the nipple, dimpling of breast skin and change in the size or the shape of the breast.^{7, 8}

Types of Breast Cancer

Breast cancer may develop in the lobules, the milk ducts or the tissue in between.⁹ Different types of breast cancer are presented in Table 2.

Diagnosis

Several types of breast cancer can be diagnosed with biopsy of the affected area in the breast. However, some types of breast cancer need specialized laboratory examinations. Mammography and physical examination of the breasts can determine whether a lump is a cancer. These two methods may also be used to detect some other lesions. Some of the most common methods of diagnosis include Axillary lymph node dissection, Lymph node biopsy, including Sentinel lymph node biopsy, Health history and physical exam, Fine needle aspiration, Diagnostic mammography, human epidermal growth

Table 2. Types of breast cancer

- Inflammatory Breast Cancer
- Medullary Carcinoma of the Breast
- Ductal Carcinoma In Situ
- Lobular Carcinoma In Situ
- Invasive Ductal Carcinoma
- Papillary Carcinoma of the Breast
- Mucinous Carcinoma of the Breast
- Invasive Lobular Carcinoma
- Cribriform Carcinoma of the Breast

factor receptor 2 status testing, Hormone receptor status testing (such as estrogen receptors, Scintimammography and progesterone receptors).^{10,11}

Treatment of Breast Cancer

Breast cancer can be treated with several methods. Surgery is the most widely used method that removes physically the tumor.^{12,13} Some types of treatments for breast cancer are outlined as follows.

Therapies with drugs

In this type of therapy, chemical drugs are used to kill the cancer cells. Some of the systemic therapies used in this area include hormonal therapy, chemotherapy and targeted therapy.¹⁴⁻¹⁷ The most commonly used drugs for chemotherapy are summarized in Table 3.

Radiation Therapy

Radiotherapy can be used to kill tumor cells. It may positively affect the tumor microenvironment. Brachytherapy (internal radiotherapy) and external beam

Table 3. Chemotherapy drugs for breast cancer

- Vinorelbine (Navelbine)
- Protein-bound paclitaxel (Abraxane)
- Paclitaxel (Taxol)
- Methotrexate (Rheumatex, Trexall)
- Ixabepilone (Ixempra)
- Gemcitabine (Gemzar)
- Fluorouracil (5-FU, Efudex)
- Doxorubicin
- Docetaxel (Taxotere)
- Cyclophosphamide
- Eribulin (Halaven)
- Epirubicin (Ellence)
- Pegylated liposomal doxorubicin (Doxil)
- Cisplatin
- Carboplatin
- Capecitabine (Xeloda)

Table 4. Radiation therapy for breast cancer

- **External-beam radiation therapy:** Known as the most common type of radiation treatment, external beam radiotherapy is delivered outside the body using a machine.
- **Brachytherapy:** This therapy beams radioactive sources into the tumor.
- **Intra-operative radiation therapy:** A probe is used to perform this type of therapy.

radiotherapy are two types of radiotherapy. Radiation can also be delivered during the operation on the breast cancer. The common types of radiation therapy are presented in Table 4.

Surgery

Some of the treatments include targeted therapy, chemotherapy, radiation therapy, surgery and hormonal therapy. Surgeries may range from mastectomy to breast-conserving surgery. Breast reconstruction can be applied during the surgery or later. Cancers with greater risk of recurrence may be treated with surgery. Mastectomy is used to remove the entire breast, while lumpectomy aims to remove the suspicious or cancerous spot. The physical removal of the tumor occurs during surgery. It is possible to perform biopsy on one or more lymph nodes during the surgery.¹⁸ Some women prefer to undergo contralateral prophylactic mastectomy. Non-surgical methods such as radiation therapy are used to target and destroy the cancerous cells.^{19,20} Breast reconstruction may be performed during surgery or later. Once cancer spreads to other parts of the body, treatments attempt to improve the quality of life of the patients. Nipple prosthesis can be applied, once the mastectomy is over.²¹ There are two main purposes behind breast cancer surgery. This type of surgery aims to treat the breast cancer successfully and reconstruct the psychosocial perspectives, including image and sexual well-being or

self-perception.²² It is important for women to be able to wear a bra and feel physically balanced in breast shape and size.²³ The two purposes mentioned above should be taken into consideration in order to make appropriate decisions for breast cancer treatment. Surgeries may range from mastectomy to breast-conserving surgery. Combined with breast conservation therapy (BCT), oncoplastic approach can be used to treat breast cancer. Women with breast cancer are reportedly more comfortable with this safe method. Using this therapy, they can save breast tissue and shape.²⁴ Accordingly, BCT, by combining the oncology principles with plastic surgery, contributes to the appropriate management of cancer. Furthermore, it improves tumor extirpation and minimizes the potential for a BCT deformity. Partial breast reconstruction was first introduced in the UK in 1990s. The patients are mostly concerned about the choice between breast conservation and mastectomy. For this purpose, plastic surgeons and surgical oncologist can help patients make the right decision.^{25,26}

Partial Breast Defects Classification and Oncoplastic Techniques for Type of Breast Defects

Breast deformities can be classified by several methods. Some of the most important classifications include breast reshaping, primary closure and local and distant flaps. The oncoplastic techniques which can be used for different types of breast defects are presented in Table 5. It should be pointed out that some of the classifications are associated with delayed reconstruction.²⁷ Considering the response to reconstruction, Clough et al. could classify the oncoplastic procedures and breast defects. Patients who suffer from Type-I breast deformity have normally shaped breast, without any other deformities. However, patients with Type-II deformity usually suffer from deformed breasts. They are typically treated with reconstruction or mastectomy.²⁸ Partial mastectomy-related breast deformity can mostly be reduced. Partial breast reconstruction can be used after the partial mastectomy. There is no need for reconstruction in small

Table 5. Different types of breast defects and suggested oncoplastic techniques

Type of breast defects	Oncoplastic technique required
Types IA, IIA and IIIA	Breast tissue advancement flaps
Type IB	Latissimus Dorsi Myocutaneous flap
Type IC	skin-sparing mastectomy
Type IIC	Lateral Thoracodorsal Flap or Latissimus Dorsi Myocutaneous Flap
Type IIIB	Bilateral Reduction Mammoplasty
Type IIIC	Bilateral Reduction Mammoplasty

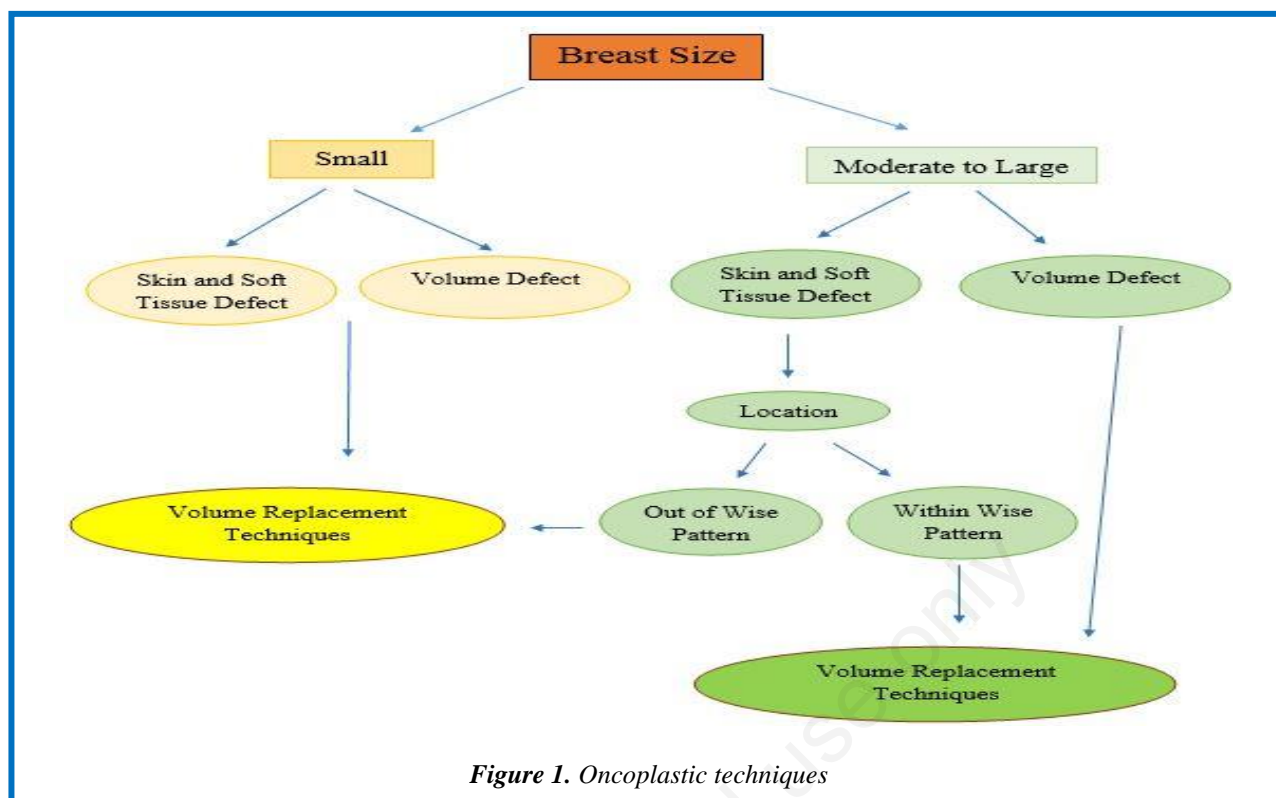


Figure 1. Oncoplastic techniques

defects in large breasts. For larger defects, breast reshaping and a contralateral breast reduction can be taken into consideration. For this purpose, it is necessary to choose appropriate techniques or a combination of procedures. It should be mentioned that reconstruction techniques are often performed with bilateral reduction mammoplasty, latissimus dorsi myocutaneous flap, breast tissue advancement flaps, abdominal flaps, bilateral mastopexy, and lateral thoracodorsal flap. Regarding the use of distant flaps in CBS, more appropriate techniques have been unanimously chosen.²⁹ Size and location of tumor in breast are two of the influencing factors that should be taken into consideration. In some patients, chemotherapy may be used to shrink the tumor. Once that process is over, the patients may undergo surgery.^{30,31} Plastic surgeon may evaluate the degree of ptosis, any evidence of prior radiation, overall skin quality and breast size. The size of the breast and affected region should be paid great attention (Figure 1). Patient with smaller size of breast suffer from low volume of glandular tissue. For this purpose, they may be in need of regionally-based flaps. It is essential to apply oncoplastic principles to reconstruction and mastectomy. It is also important to understand different varieties of mastectomy techniques in order to obtain the optimal outcomes. Given the tumor location, the appropriate reduction technique and the design of the nipple/areolar pedicle are selected.^{32,33} While maintaining the breast shape and appearance, the cancer may be resected with surgical margins. For a surgery to be performed successfully, it is necessary to use breast imaging because it is capable of predicting the

orientation of disease and histological extent accurately. Mammography detects asymptomatic breast cancers. Imaging methods can be efficiently used to diagnose the tumor mass.³⁴ Volume replacement and volume displacement are among the most widely used types of reconstruction, each of which have different techniques. Some of the techniques specifically attributed to the volume replacement are primary closure mirror (such as biopsy/excisions; batwing mastopexy), reduction mastopexy, breast flap and parenchymal (such as remodeling, volume shrinkage).³⁵ While the techniques specifically attributed to the volume replacement are distant flaps, adjacent or distant tissue transfer, local flaps (such as fascio cutaneous, perforator), implant augmentation and volume preserving. Depending on the size of tumor, location of tumor, breast size and patient's desires, volume displacement may seem much more appropriate.³⁶ Oncoplastic surgery is a combination of the principles of plastic surgery and oncology. It uses breast flap advancement to address tissue defects and improve cosmesis. Breast conserving surgery (BCS) followed by radiation treatment comprises BCT. Masetti et al. developed a four-step design for oncoplastic operations which can be applied in several cases.^{21,37,38} Fundamentally, oncoplastic procedures attempt to minimize cosmetic detriment to the breast.

Clinical Outcomes of Breast Reconstruction

Breast cancer reconstruction still remains a challenging area for oncologists and plastic surgeons. Before performing radiotherapy, an optimal treatment is needed.^{25,39} So far, there is not sufficient evidence for the

aesthetic clinical and safety results of the oncoplastic techniques. This can be attributed to the small number of patients and less experienced surgeons. In the past, cancer was described as a systemic illness. Then, several sparing procedures were developed. However, it is necessary to collect sufficient data on the metastasis and overall survival in these procedures.⁴⁰ Kronowitz et al. examined 69 patients and reported recurrent oncoplastic reconstructions (P=0.06).²⁵ In addition, Clough et al.²⁸ investigated the patients who had undergone oncoplastic reconstruction and BCS. Local recurrence was reported in 11 cases (5-year local recurrence rate was 9.4%). Accordingly, 8 patients died and 13 patients developed metastases.⁴¹ Oncoplastic procedures suffer from limited evidence regarding the aesthetic results. There are several methods for aesthetic evaluation.⁴² According to some authors, glandular and skin tissue resection can affect the aesthetic outcome.⁴³

Advantages and Disadvantages of Partial Breast Reconstruction

Mastectomy and implant reconstruction offers several advantages for good candidates of oncoplastic reconstruction.^{26,44,45} Oncological safety is one of the most prominent advantages of partial breast reconstruction.⁴⁰ Anderson et al. investigated different oncoplastic approaches for partial mastectomy. Partial breast reconstruction is capable of enhancing the probability of achieving better surgical margins. Surgical treatments of breast cancer have their own advantages and disadvantages. Oncoplastic breast surgery can be used to obtain optimal aesthetic outcomes for women with breast cancers, especially for women who would not obtain acceptable outcomes with other techniques. It is essential to apply oncoplastic principles to mastectomy and reconstruction and to understand the different varieties of mastectomy techniques to obtain the better outcomes, but further research is required to examine the capacities of some other methods, such as flap operations.

Limitations of Oncoplastic Breast Surgery

Oncoplastic breast surgery may delay the adjuvant therapy and lead to some complications. Complications of oncoplastic reconstruction are nipple areola complex necrosis, skin/flap necrosis, seroma, hematoma, infection, fat necrosis and wound dehiscence. Recently, it was reported that the average complication rate for the oncoplastic reduction mammoplasty group and the oncoplastic flap reconstruction group was 16% and 14%, respectively. Accordingly, the initiation of adjuvant therapy was not delayed. Complications in oncoplastic groups may not negatively affect patient care. To reduce morbidity rate, it is essential to select proper techniques.

Conclusion

Oncoplastic approaches are used to obtain better outcomes for women with breast cancer, attempting to minimize cosmetic detriment to the breast.

List of acronyms

BCS - breast conserving surgery
BCT – breast-conserving therapy

Authors contributions

All authors played a role in the conception and study design, data acquisition and analysis, drafting, and approval of the final version.

Acknowledgments None.

Funding No funding was obtained for this research project.

Conflict of Interest

The authors declare they have no financial, personal, or other conflicts of interest.

Ethical Publication Statement

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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- Submissions: March, 9, 2019
Revision received: April 11, 2019
Acceptance: April 11, 2019