



Strategies for the selection of oncoplastic techniques in the treatment of early-stage breast cancer patients

Shengchao Huang, Pu Qiu, Jianwen Li, Zhongzeng Liang, Zeming Yan, Kangwei Luo, Baoyi Huang, Liyan Yu, Weizhang Chen, Yuanqi Zhang

Department of Breast Surgery, Affiliated Hospital of Guangdong Medical University, Zhanjiang, China

Contributions: (I) Conception and design: Y Zhang; (II) Administrative support: J Li; (III) Provision of study materials or patients: S Huang, P Qiu; (IV) Collection and assembly of data: Z Liang, Z Yan, K Luo; (V) Data analysis and interpretation: B Huang, L Yu, W Chen; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Yuanqi Zhang. Department of Breast Surgery, Affiliated Hospital of Guangdong Medical University, Zhanjiang 524001, China. Email: 31428319@qq.com.

Background: In recent years, breast cancer is the most common malignancy in women. The traditional method of surgery is to remove a woman's breast completely, which has a negative impact on her work and life. Today, women have a fiery pursuit to maintain their perfect figure, which has forced breast surgeon to find a new surgical approach to maintain the shape of the breast after surgery.

Methods: This study systematically analyzed and summarized the incision design and repair of glandular defects in early-stage breast cancer patients by oncoplastic breast techniques. By summarizing the methods of oncoplastic breast surgery (OBS) in different quadrants, it could help beginners to master this technology more quickly, so as to provide better help for breast cancer patients.

Results: A total of 216 breast cancer patients who underwent OBS from January 2016 to June 2020 at the Affiliated Hospital of Guangdong Medical University were included in this study. In patients treated with the volume-displacement method and the volume-replacement method, 92.6% and 86.2% of patients achieved excellent breast shape, respectively.

Conclusions: OBS is a safe and effective way to treat early-stage breast cancer while obtaining better breast shape, reducing postoperative psychological trauma, and improving quality of life.

Keywords: Oncoplastic techniques; early-stage; breast cancer

Submitted Mar 10, 2021. Accepted for publication Apr 29, 2021.

doi: 10.21037/gs-21-212

View this article at: <http://dx.doi.org/10.21037/gs-21-212>

Introduction

Breast cancer is a highly prevalent female malignancy in China, affecting approximately 280,000 women annually. Breast cancer occurs most commonly in women aged 45–55 years and thus, has a serious impact on a woman's career and quality (1-3). With improvements in breast ultrasound examination by medical institutions, most breast tumors are detected in the early stages, and the 5-year overall survival rate after standardized treatment exceeds 80% (4). Nowadays, breast cancer patients attached great importance to the aesthetic effect of the breast after surgery (5,6).

Several studies have shown (7-10) no significant differences in overall survival, disease-free survival, local recurrence, distant metastasis rates, and overall efficacy between breast-conserving surgery and radical breast cancer treatment. However, studies have shown that approximately 20–30% of patients who underwent traditional breast conservation had poor cosmetic results due to the absorption of serum in the tumor cavity or postoperative radiotherapy, resulting in breast deformities (11,12). In fact, some patients forgo breast conservation because they cannot obtain satisfactory cosmetic outcomes due to their small breast size, large tumor size, or tumor location restrictions.

Oncoplastic breast surgery (OBS) is a novel approach to breast conservation surgery that combines the aesthetic concepts of plastic surgery with the radical concepts of oncological surgery. Unfortunately, lots of breast treatment centers do not promote this technique (13). The purpose of this study is to explore the selection of appropriate OBS techniques to repair the defects after breast tumor resection in different locations, including the choice of surgical incision and the use of nearby glands to repair the defects.

We present the following article in accordance with the STROBE reporting checklist (available at <http://dx.doi.org/10.21037/gs-21-212>).

Methods

Patients

This study was a retrospective analysis. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by regional ethics board of Affiliated Hospital of Guangdong Medical University (No.YS20201600) and informed consent was taken from all the patients.

Inclusion criteria:

- (I) Age ≥ 18 years old;
- (II) Breast cancer was confirmed by preoperative pathology;
- (III) The clinical stages were I and Anal;
- (IV) Postoperative systematic treatment can be completed according to the doctor's advice;
- (V) The patient was informed of the operation method and signed the consent form.

Exclusion criteria:

- (I) patients with severe chronic heart and brain diseases;
- (II) Patients with neurological or psychiatric diseases;
- (III) Patients cannot cooperate to complete follow-up visits.

A total of 220 patients with early breast cancer who were treated at Affiliated Hospital of Guangdong Medical University from January 2016 to June 2020 were selected as the research objects. Among the enrolled patients, the oldest was 68 years old, the youngest was 28 years old, and the median age was 48.5 years old. According to the individual condition of the patient, the volume displacement method or volume replacement method is selected in the operation. Patients were followed up by two independent investigators.

Postoperative breast aesthetics was evaluated using Harris evaluation criteria. Two independent investigators collected patients' satisfaction with their breast one year after surgery

Statistical analysis

SPSS 18.0 was used for statistical analysis; enumeration data was represented by percentage (N/%); Chi-square test was used, $P < 0.05$ indicated that the difference was statistically significant. Missing data were not included in the study.

Incision design of OBS

The presence of a breast incision scar is one of the most important indicators to evaluate its aesthetics (14). The incision design should satisfy both radical removal of the cancerous tissue and concealment of the incision location. Prior to surgery, the incision site will be determined according to the tumor location and size, the position of the nipple areola, and the volume and sagging of the breast. In addition, the choice of incision has a great impact on the whole surgical process and postoperative breast beauty. Based on the OBS experience in our department, the following criteria were developed:

- (I) If the tumor is close to the areola area and more than 2 cm from the nipple, but does not invade the nipple areola, a double circumferential incision can be adopted;
- (II) If the tumor is located in the upper pole of the nipple-areola complex, an Omega incision or an inverted T-shaped incision can be made;
- (III) If the tumor is located in the lower pole of the nipple-areola complex, an inframammary fold incision or an inverted T-shaped incision may be made;

If the tumor is located above the level of the nipple, a shuttle incision, parallelogram incision, or curved incision can be adopted. If the mass is close to the axillary position, Tan *et al.* (15) suggests a radial incision to extend to the axilla. In addition, lymph node biopsies or axillary lymph node dissections may be feasible while removing the cancerous tissue, after which the gland can be freed for repair;

If the tumor is located below the level of the nipple, the surgery can be performed with a J-shaped incision, an L-shaped incision, or a V-shaped incision;

If the tumor is located in the central region of the tumor, a shuttle incision including the nipple-areola complex can be designed, and reconstruction of the nipple-areola is



Figure 1 Breast defect repair by advancement of residual gland suture.

feasible at a later stage to ensure the aesthetics of the breast;

A tennis racket incision design may be used when the tumor is located lateral to the same level of the nipple;

To perform axillary lymph node dissection, a small arc-shaped incision should be designed along the skin line in the axilla, while preserving as much axillary fat as possible to avoid affecting the postoperative axillary shape.

Surgical techniques for the repair of breast defects in different quadrants

Clough's classification criteria (16) is the most explicit: the proportion of the removed gland that takes up the entire breast can be divided into three levels: (I) when the resection volume is less than 20%, it is classified as type I, and the residual cavity can be repaired by direct suturing of the residual breast tissue to repair the defect; (II) when the resection volume is 20–50%, it is classified as type II, which requires more complex plastic surgery techniques to repair the residual cavity and shape; and (III) when the amount of excision is more than 50%, it is classified as type III, which requires total mastectomy followed by reconstructive surgery with autologous breast tissue or artificial prosthesis. This study focused on residual cavity repair for glandular excision of 20–50%, as the choice of repair method is often not clear to many breast surgeons.

Glandular excision less than 20%

If the mass is small and the removal of a small amount of the gland has little effect on the postoperative breast appearance, a radial or curved incision can be made in the skin above the tumor. Surgeon can pull adjacent glands closer and sew them together to reshape the breast without

the need for OBS techniques. However, some studies (17) indicate that because the volume of the removed gland is relatively small, not suturing the adjacent mammary gland may guarantee a satisfactory breast appearance. However, the long-term cosmetic benefits of this method have not been proven (*Figure 1*).

Volume-displacement method

The removal of up to 20–50% breast gland, along with the need to remove some of the skin, can cause significant deformities in the appearance of the breast. Restoring the appearance of the breast is a challenge for every breast surgeon. OBS can be divided into the volume-displacement method and the volume-replacement method. For glandular defects of 20–50%, volumetric transfer is the most common method, and if volumetric transfer is not possible, then volumetric substitution is preferred.

Racket-shape oncoplastic breast conservation method

The racket-shape oncoplastic breast conservations method is suitable for tumors located at the same level of the nipple in the lateral and upper outer quadrant, mainly to avoid the nipple-areola complex from tilting outward and upward. A concentric incision is made at the edge of the areola and the epidermis is removed from the concentric circles. A shuttle-shaped incision is then made along the breast mass to remove the tumor. The breast is reshaped into a semicircle by the assistant using both hands, while the surgeon frees the medial and lateral glands and pulls them together, and sutures them to fill the breast defect and complete the reconstruction of the breast shape. The surgeon then performs a re-centering of the nipple-areola complex (*Figure 2*).

J-shape oncoplastic breast conservation method

The J-shape oncoplastic breast conservation method is

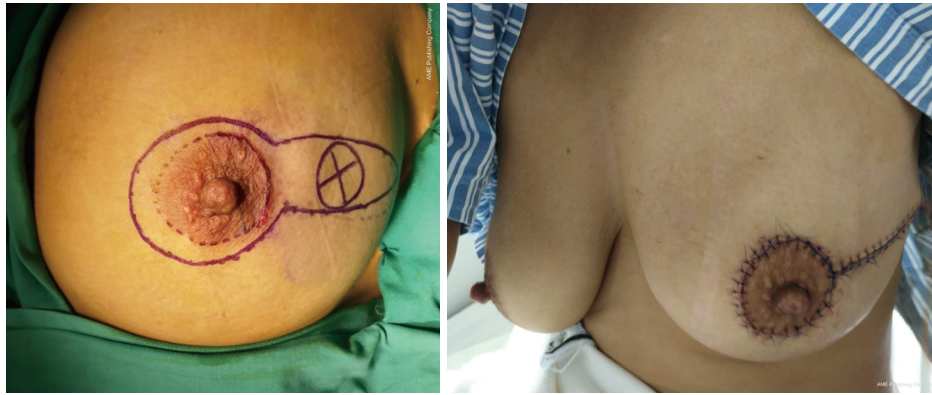


Figure 2 Racket-shape oncoplastic breast conservation method.



Figure 3 J-shape oncoplastic breast conservation method.

suitable for tumors located below the level of the nipple. A concentric circular incision is made around the areola and the epidermis is removed. Curved incisions are made along the medial and lateral sides of the areolar incision and turned towards the inframammary fold. After removal of the mass, the surgeon frees the medial and lateral glands, sutures them together and then fills the breast defect to complete the glandular reconstruction. The nipple-areola complex is then recentered. This approach was pioneered by Lassus *et al.* in 1996 (18) and has the advantage of preventing deformities in the outer lower quadrant (*Figure 3*).

Inverted T-shape oncoplastic breast conservation method

The inverted T-shape oncoplastic breast conservation method is suitable for tumors located in the upper or lower pole of the nipple-areola complex with breast ptosis. The width and depth of the superior tip of the tumor is

measured and a preoperative line is drawn, then the skin is cut and the epidermis of the superior tip is removed. On the premise of ensuring the blood supply to the nipple areola, the mass is removed intact, the medial and lateral glands are freed to form free glandular flaps and then the nipple areola is lifted and re-centered. Subsequently, the medial and lateral free glandular flaps are pulled together and sutured toward the midline of the inframammary fold to form the new inframammary fold of the breast. This method was first proposed by Clough *et al.* (19) in 1990 and has the advantage of preventing a “beak-like” deformity of the breast due to skin wrinkling and downward displacement of the nipple-areola complex (*Figure 4*).

Z-shape oncoplastic breast conservation method

The Z-shape oncoplastic breast conservation method is suitable for tumors located at 6 o’clock with flattened or



Figure 4 Inverted T-shape oncoplastic breast conservation method.



Figure 5 Z-shape oncoplastic breast conservation method.

mildly sagging breasts (*Figure 5*).

A-T-shape oncoplastic breast conservation method

The A-T shape oncoplastic breast conservation method is suitable for plastic breast conservation in cases where the tumor is located in the lower or outer lower quadrant of the breast (*Figure 6*).

Omega-shape oncoplastic breast conservation method

The omega-shape oncoplastic breast conservation method is suitable when the tumor is located in the upper pole of the nipple-areola complex. A located in the upper pole of the nipple-areola complex to excise part of the skin, the breast tumor, and the surrounding normal glandular tissue. The glandular tissue below is then freed, the free glandular body is lifted and the breast defect is repaired with parallel sutures. The nipple areola complex is then lifted and

recenter. In 2005, Anderson and colleagues were the first to report (20) an omega-shape breast-conserving procedure, with the main advantage of lifting the gland below the tumor to repair the upper pole of the defect, thereby improving the postoperative sagging of the breast (*Figure 7*).

Double ring-shape oncoplastic breast conservation method

The double ring-shape oncoplastic breast conservation method is suitable for tumors located next to the areola with mild sagging of the breast. A circular incision is made along the areola, another circular incision is made outside the circular incision according to the size and location of the tumor, the position of the nipple, and the degree of breast ptosis. The inter-ring epidermis is removed, the gland surface at the outer ring is fully freed, and the soft tissue in the area where the tumor is



Figure 6 A-T-shape oncoplastic breast conservation method.



Figure 7 Omega-shape oncoplastic breast conservation method.

located is excised in its entirety. Then, the medial and lateral glands are pulled together and intermittently sutured to repair the defect and reshape the breast, followed by centralization of the nipple-areola complex. This method was first reported by Benelli in 1990 (21) and has the main advantage of preventing displacement of the nipple-areola complex (*Figure 8*).

V-shape oncoplastic breast conservation method

When the tumor is located below the level of the nipple, especially in the lower inner quadrant, the V-shape oncoplastic breast conservation method is performed. A circular incision is made at the edge of the areola and the epidermis is removed along the incision, followed by a triangular incision including the mass (the intersecting point of the incision is located at the edge of the areola and the lower boundary of the incision is located at the breast fold). After complete excision of the mass, the

lateral glandular flap is freed, pulled inward and sutured to repair the inframammary fold to complete the glandular reconstruction, followed by centralization of the nipple-areola complex (*Figure 9*).

Arbitrary flap method

When flatter breasts are accompanied by skin invasion, the arbitrary flap method can be used for breast defect repair (*Figure 10*).

Volume replacement method

According to the Chinese Expert Consensus on Treatment of Breast Conservation (2020 version) (22), volume-replacement techniques, mainly adjacent flap transfer and distal flap transfer, are recommended when local soft tissue repair or free adjacent gland repair after mastectomy of the cancer site would create a deformity such as breast depression.



Figure 8 Double ring-shape oncoplastic breast conservation method.



Figure 9 V-shape oncoplastic breast conservation method.

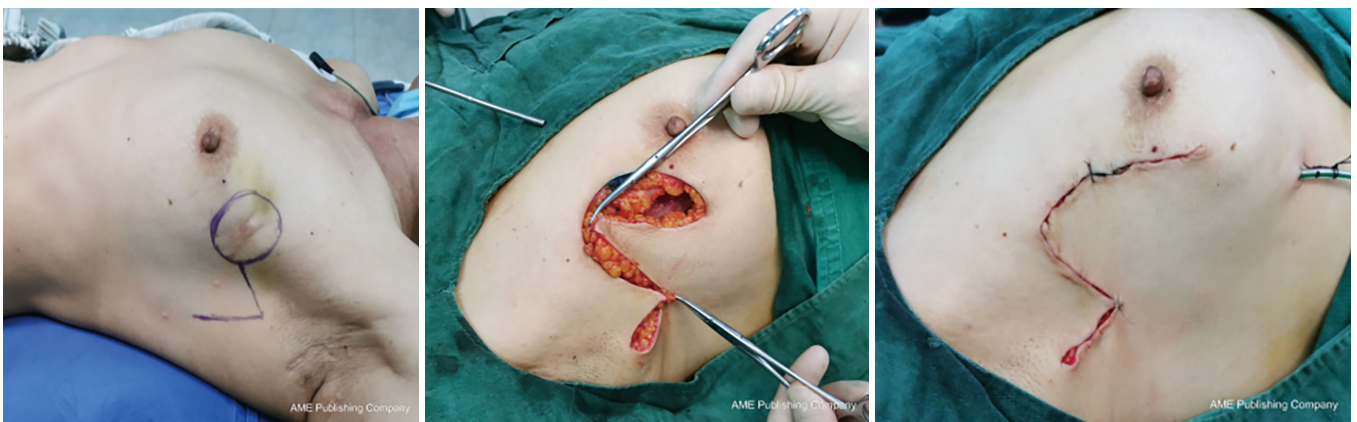


Figure 10 Arbitrary flap method.

Application of lateral thoracic vascular perforator flap
 Lateral thoracic vascular perforator flap, intercostal vascular perforator flap, and dorsal thoracic vascular perforator flap can be used for repair of larger defects after mastectomy. These flaps are particularly suitable for plastic repair where

the tumor is located laterally and superiorly, but only for repair of smaller breast defects (*Figure 11*).

Application of the greater omentum
 The large omentum is rich in blood vessels and lymphatic vessels, and its rich blood flow gives rise to its strong



Figure 11 Application of lateral thoracic vascular perforator flap.

absorption and anti-inflammatory function, which can reduce the incidence of subcutaneous seroma, and result in a soft enough feel and fast postoperative recovery. However, due to its limited tissue volume, it is not suitable for repair of larger breasts (*Figure 12*).

Application of the mini-tipped latissimus dorsi flap

The anatomical position of the thoracodorsal artery of the latissimus dorsi flap is constant, which has the advantages of a long vascular tip, thick vascular tip caliber, and high flap viability. In addition, the latissimus dorsi flap can be cut with a wide flap area, and the donor area can be directly pulled together and sutured, resulting in little influence on upper limb function. Furthermore, it can be used for breast defect repair in any quadrant and is most commonly used for breast repair with large defects (*Figure 13*).

Results

A total of 220 patients who underwent oncoplastic breast treatment from January 2016 to June 2020 at the Affiliated Hospital of Guangdong Medical University were included in this study. Within the study cohort, 140 patients were treated with the volume-displacement method (group A) and 80 patients received the volume-replacement method (group B). The median age of the cohort was 48.5 years, with a range of 28–68 years. All surgeries were performed by the same surgical team. Patients with positive margins required a second expansion surgery to obtain negative margins. No contralateral breast symmetry surgery was performed in patients in either group. Their postoperative diagnosis confirmed early breast cancer. All patients were followed up for 1 year postoperatively for breast satisfaction

by two independent investigators. The location, shape, size, and symmetry of the breasts were assessed using the Harris evaluation criteria (23). The satisfaction rate of postoperative breast aesthetics was 90.9% in group A and 89.3% in group B after 1 year, suggesting that there was little difference between two methods. Eight patients in Group A and 5 patients in Group B were lost to follow-up. The final follow-up rate was 132/140 (94.3%) for Group A and 75/80 (93.8%) for Group B. There was no statistical difference between the two groups ($\chi^2=0.136$, $P=0.712$). And missing follow-up data were not included in the satisfaction statistics (*Table 1*).

Discussion

Currently, Breast cancer harms women seriously and has a high incidence in the world. On the one hand, women's menarche time, lactation and endocrine disorders and other problems will cause abnormal metabolism in the body, thus leading to the occurrence of breast cancer. On the other hand, heredity is a high risk factor for breast cancer. Breast cancer has a genetic susceptibility problem, which is very obvious among family sisters, mother and daughter. In addition, smoking, drinking and other bad habits will cause damage to the body's various functions, can induce the occurrence of breast cancer. Surgical treatment of breast cancer has always been a hot research topic

In 1993, the German surgeon Dr. Audretsch officially introduced the term "oncoplastic surgery", which is derived from the Greek words "onco" (tumor) and "plastic" (plastic) (24). It is essentially a plastic surgery procedure that ensures the best cosmetic outcome while ensuring

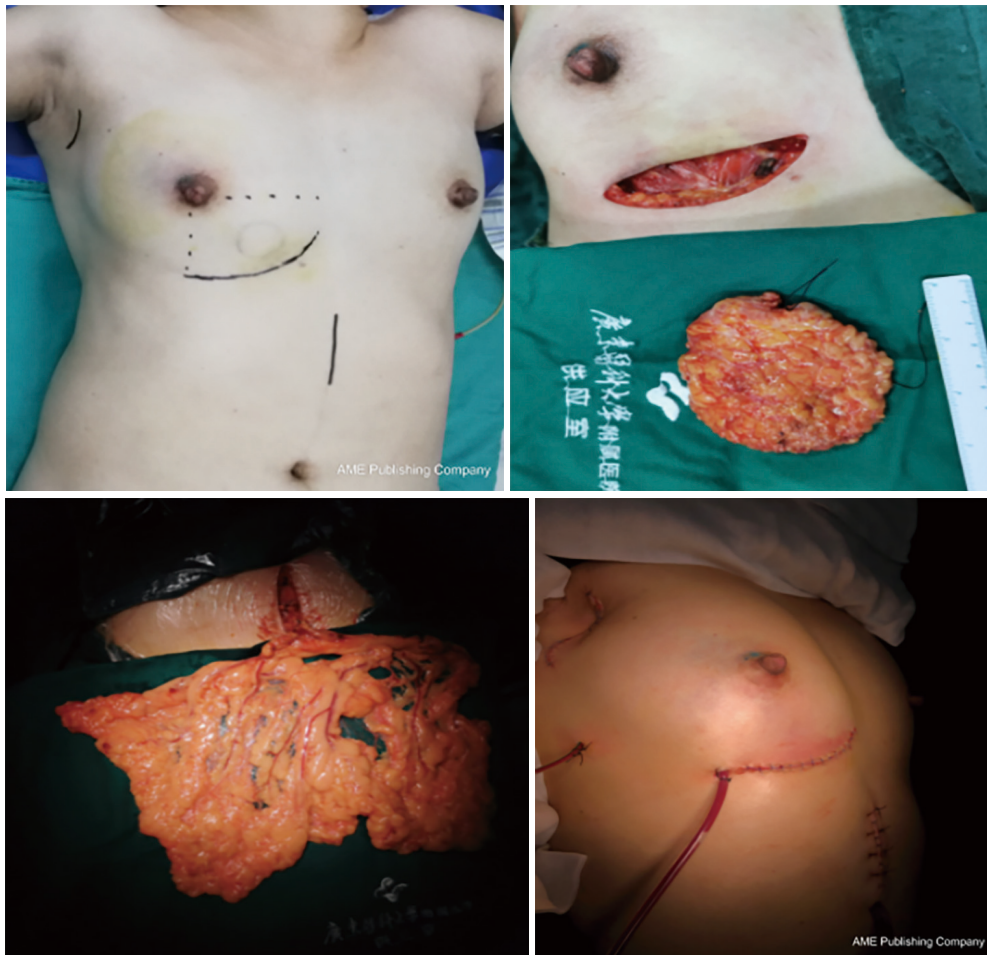


Figure 12 Application of the greater mentum.



Figure 13 Application of the mini-tipped latissimus dorsi flap.

Table 1 Postoperative patient satisfaction with aesthetics

Group	Excellent (%)	Good (%)	Discontent (%)	Satisfaction rate (%)	χ^2	P
Group A	106 (80.3)	14 (10.6)	12 (9.1)	90.9	0.136	0.712
Group B	58 (77.3)	9 (12.0)	8 (10.7)	89.3		

Group A includes patients who were treated with the volume-displacement method. Group B includes patients who were treated with the volume-replacement method.

radical removal of the tumor. This method quickly became popular in many countries including France, Italy, and the United Kingdom, where the rate of plastic surgery for breast tumors increased from 40% in 1991 to 60% in 2002, and this rate continues to rise (25). In 2005, Zhang and Shao (26) reported 872 cases of breast cancer patients who underwent OBS. An aesthetic satisfaction rate of 91.1% at 1 year and 86.6% at 2 years after surgery was achieved. In 2015, Xuanwu Hospital of Capital Medical University reported that 10 patients received OBS, 8 of them were very satisfied with the breast shape after surgery, and 2 of them were satisfied with the breast shape after surgery (27). Similarly, a study of Dalian University School of Medicine reported that the satisfaction of 29 patients with early breast cancer who underwent breast tumor plastic surgery was 75.9% (22/29) (28).

In 2013, relevant data from several clinical research centers showed (29) that the 5-year overall survival rate after OBS was 92.5–95.7%, and the 5-year local recurrence rate was 0–9.4%, while the local recurrence rate of traditional breast-conserving surgery was 10–14%. Results of NSABP-06 clinical study showed (30) that there was no Statistical difference in DFS and OS between patients receiving breast conserving surgery and radical mastectomy (36.0% *vs.* 35.0%, $P=0.26$; 47.0% *vs.* 46.0%, $P=0.57$). The EORTC10801 clinical study (31) compared the efficacy of modified radical surgery and breast-conserving surgery combined with radiotherapy in patients with early-stage breast cancer (regardless of axillary lymph node condition). Patients treated with modified radical surgery had a better 10-year local control rate, but the difference in OS rate between the two groups was not statistical difference (46.0% *vs.* 39.0%, $P=0.23$). Losken published the results of a meta-analysis of OBS techniques (32): compared with traditional breast conserving, OBS had a lower margin positive rate (12% *vs.* 21%), a lower re-excision rate (4% *vs.* 14.6%), and a lower local recurrence rate (4% *vs.* 7%) due to the removal of more surrounding tissue.

In China, modified radical surgery and traditional breast-

conserving surgery are the two mainstream modalities for the treatment of patients with breast cancer (33). The former results in the absence of the female breast due to the removal of all glandular tissues. In the latter approach, too much normal glandular tissue may be removed in order to reduce local recurrence of the tumor. This may lead to nipple displacement, local breast depression, breast deformation, and bilateral breast asymmetry, resulting in breast deformity and seriously affecting postoperative cosmetic outcomes. Importantly, both breast loss and deformity can result in psychological barriers, social barriers, and career barriers for female patients (34,35), and cause both physical and mental strain (36,37). Therefore, it is imperative to develop plastic surgery concepts and techniques to improve postoperative cosmetic breast outcomes during breast cancer conserving surgery to improve the quality of life of these patients. There are many factors affecting the aesthetic effect of breast, including the size and location of the tumor, the size and density of the breast, the ratio of the tumor's volume of the breast, whether the breast droops, the concealment of the incision and others. Therefore, we need to take all of these factors into account when we design the incision for OBS. In addition, major complications of OBS include bleeding, subcutaneous effusion, delayed wound healing, infection, seroma, adipose necrosis, and flap necrosis. Subcutaneous effusion is the most common complication, but it is self-limited and does not require additional treatment.

The indications for OBS are more extensive than for traditional breast conserving. It is mainly suitable for breast cancer with large tumor volume, multifocal tumor, skin invasion and tumor located in the lower pole and inner region, which is easy to cause deformity. The goals of OBS include complete removal of the lesion, clean incision margins, good to excellent cosmetic results, and completing all steps in one surgery. The key to the success of OBS is achieving negative surgical margins. The range of safe tumor excision of normal glandular tissue varies from a few millimeters to 2–3 cm, but the exact standard

value is still controversial. The guidelines of the American Society of Surgical Oncology and the American Society of Radiation Oncology (38) regarded “no ink on tumor” as the standard for breast-conserving surgery, however, it was more difficult to operate in practice. According to our clinical experience, to achieve a safe range of tumor excision, the tumor and the surrounding 1.5–2.0 cm of normal gland should be removed. Furthermore, the upper, lower, anterior, posterior, medial, and lateral margins should be sent for frozen pathology to confirm the presence or absence of cancer cells. If any of the margins appear positive, the resection should be expanded until the margins are negative. The American Society of Breast Surgeons (ASBS) defines oncoplastic techniques as complete excision of the breast tumor under the principle of anaplasia with the use of plastic techniques such as glandular flap transfer and myocutaneous flap transfer to achieve optimal aesthetic results in the breast (39). In addition, selecting the optimal OBS method based on the assessment of the volume of the breast and the location of the tumor is the key to ensuring the cosmetology of the breast post-surgery.

Although no statistical analyses of postoperative complications were conducted in this study, the above results demonstrated that there was no significant difference in the cosmetic effect between the volume-displacement method and the volume-replacement method. Therefore, OBS technology is suitable for promotion and application in patients with early-stage breast cancer. In the later stage, we will increase the number of patient samples and summarize the incidence of related complications to further verify the conclusion.

OBS is a superior method for the treatment of patients with clinical stage I and II breast cancer, because it avoids total mastectomy and guarantees a thorough radical tumor treatment and postoperative cosmetic breast effect (40). In 2014, a study (41) compared and analyzed the postoperative cosmetic effects of OBS and non-OBS in patients with early breast cancer. The excellent and good rate of breast cosmetic effect evaluation in OBS group was 86.8%, while that in non-OBS group was 67.2%. The total satisfaction rate of OBS group was 92.5% (62/67), and that of non-OBS group was 80.2% (93/116). The difference between the two groups was statistically significant ($P < 0.01$). Moreover, report (42) has shown that, compared with modified radical surgery, OBS has a significant relieving effect on postoperative depression, and OBS has a very important positive impact on postoperative self-esteem of patients.

In traditional surgical procedures, women who underwent mastectomies perceive themselves as incomplete. What's more, women's sense of self-identity plummeted in response to the side effects of chemotherapy. As a result, they will have less contact with the outside world, and even have suicidal thoughts.

In recent years, a European data on early-stage breast cancer shows (43) that more than 78 percent of breast conservation treatments are available in Europe and the United States. The breast-conserving rate in Asia is generally lower than that in Europe and the United States, but recently, the breast-conserving rate in Japan, Singapore and Hong Kong of China has all exceeded 40% (44-46). But in China, the breast-conserving rate in more than half of hospitals was less than 20% (47). In addition, the breast-conserving rate is related to the per capita GDP of the area where the hospital is located.

Conclusions

In conclusion, OBS is a superior treatment modality for early-stage breast cancer because it can remove the cancer lesion while obtaining satisfactory breast shape, reduce postoperative psychological trauma, and improve the quality of life for patients.

Acknowledgments

Funding: None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <http://dx.doi.org/10.21037/gs-21-212>

Data Sharing Statement: Available at <http://dx.doi.org/10.21037/gs-21-212>

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/gs-21-212>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are

appropriately investigated and resolved. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by regional ethics board of Affiliated Hospital of Guangdong Medical University (No.YS20201600) and informed consent was taken from all the patients.

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(English Language Editor: J. Teoh)

Cite this article as: Huang S, Qiu P, Li J, Liang Z, Yan Z, Luo K, Huang B, Yu L, Chen W, Zhang Y. Strategies for the selection of oncoplastic techniques in the treatment of early-stage breast cancer patients. *Gland Surg* 2021;10(5):1687-1700. doi: 10.21037/gs-21-212