



## SPECIAL ARTICLE

# Volume displacement techniques in oncoplastic breast conserving surgery



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Received 7 October 2021; accepted 8 October 2021

### KEYWORDS

Oncoplastic;  
Breast conserving  
surgery;  
Mammoplasty

**Abstract** We present an overview of volume displacement techniques within the context of oncoplastic breast conserving surgery. These techniques involve mobilising breast tissue to reconstruct the defect caused by tumour wide local excision. They can therefore extend the indications for breast conserving surgery. Commonly used techniques are described including their anatomical basis, clinical indications, recognised complications and the potential benefits to the patient compared to mastectomy and total breast reconstruction.  
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### PALABRAS CLAVE

Oncoplástica;  
Cirugía conservadora  
de la mama;  
Mamoplastia

**Técnicas de desplazamiento de volumen en cirugía oncoplástica conservadora de la mama**

**Resumen** Presentamos un resumen de las técnicas de desplazamiento de volumen en el contexto de la cirugía oncoplástica conservadora de la mama. Dichas técnicas implican la movilización del tejido de la mama para reconstruir el defecto causado por la resección local de la extensión tumoral. Por tanto, pueden ampliarse las indicaciones a la cirugía conservadora de la mama. Se describen las técnicas habitualmente utilizadas, incluyendo su base anatómica, indicaciones clínicas, complicaciones reconocidas y beneficios potenciales para el paciente, en comparación con la mastectomía y la reconstrucción total de la mama.  
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## Introduction

Oncoplastic breast conservation surgery (BCS) is an established technique which combines breast excision with additional procedures aiming for improved aesthetic

outcomes. This is supported by the established long-term safety of BCS compared to mastectomy.<sup>1,2</sup> Randomised clinical trials have shown equivalent survival for the two techniques<sup>3,4</sup>, and Local recurrence rates are comparable.<sup>6,7</sup> The safety of oncoplastic breast surgery has been demonstrated in multiple studies including a meta-analysis of 18,103 patients showing no difference in recurrence

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compared to standard breast conserving surgery or mastectomy.<sup>5,7,19</sup>

The main challenge in BCS is to achieve a balance between adequate margins of excision and obtaining acceptable cosmetic outcome and minimising the number of procedures required. Oncoplastic breast conservation may be of particular importance in patients that are at a higher risk of incomplete excision with simple BCS techniques. They may include those with ductal carcinoma in situ, invasive lobular cancer and women younger than 40 years of age.<sup>11</sup>

Simple breast conserving surgery may compromise breast shape, symmetry and contour and studies have also shown a correlation between percentage of breast volume excised and both patient satisfaction and objective cosmetic assessments, particularly if greater than 10%.<sup>16,20</sup>

Clough et al classified oncoplastic surgery into two levels depending on percentage of breast resection required.<sup>13</sup> Level I includes resection up to 20% of the breast and includes parenchymal mobilisation, approximation of tissues and re-positioning of nipple areolar complex as potential corrective strategies.

Level II procedures include more than 20% of breast volume resection and are potential indications for volume displacement or replacement techniques. Excellent outcomes using volume displacement techniques can be achieved in women with large tumours and large breasts.<sup>21</sup>

For patients with small to medium breast size, with minimal or no ptosis, or do not wish to consider volume reduction then volume replacement technique are an alternative.

The focus of this review will be on volume displacement techniques, the indications for them and surgical planning.

## Indications and principles of oncoplastic breast conserving surgery

Oncoplastic techniques should be considered when a significant percentage of the breast is expected to be resected and also when the tumour excision is in a potentially cosmetically challenging area of the breast, such as the lower pole or upper inner quadrant.<sup>1</sup>

These techniques are often applied in large tumours, and studies have shown that oncoplastic BCS is safe for cancers up to 5cm and there is little evidence to justify the use of tumour size alone as an exclusion criteria for breast-conservation therapy.<sup>7,9</sup>

The principles of oncoplastic BCS as described by RD Macmillan<sup>17</sup> include the following:

- Choose safety over perfect cosmesis.
- Do not compromise on tumour wide local excision.
- Perform techniques within your own skill set.
- Perform the simplest procedure that gives an acceptable result.
- Maintain breast form and shape keeping in mind gentle tissue handling as traumatised parenchyma can lead to fat necrosis.
- Fibrosis induced by radiotherapy and scar contracture pulling the nipple towards it and beaking of the nipple should be kept in mind.

- Aim for all necessary surgery including symmetrisation to be completed at one operation.

## Planning of volume displacement techniques

The expectations of patients undergoing oncoplastic BCS must be explored and discussed. It is imperative to be honest and realistic with patients in terms of the potential outcomes. Knowledge and adequate information given, are the foundations of informed consent and surgical planning. Beyond the well-recognised complications of simple breast conserving surgery, the patient must be made aware of the pattern of scarring, potential need for contralateral surgery, possibility of completion mastectomy in the event of incomplete tumour excision, reduction or loss of skin and nipple sensation and loss of nipple. Fat necrosis can give rise to worrisome lumps in the breast. Patients should be aware of a possible delay in adjuvant treatment in the event of any complications (including as a result of complications on the normal breast if symmetrising surgery is undertaken). Risk factors for complications include a high BMI, smoking, large breasts and diabetes.

The main techniques of oncoplastic BCS are highlighted below<sup>14,15</sup>

### Simple parenchymal mobilisation, round block and tennis racket mastopexy

Very rarely is there a need to remove skin over a breast cancer unless the cancer is directly involved with it. Positioning scars directly on the breast is therefore rarely indicated. Periareolar or circumareolar incisions can be forgiving sites of incision and often a "gateway to different quadrants of the breast. The round block or sometime called the Benelli technique is performed by making two concentric periareolar incisions, followed by de-epithelialisation of the intervening skin. The outer edge is incised and skin flap raised to allow access to the tumour. Wide local excision is performed from subcutaneous fat to the pectoralis major fascia. The breast parenchyma is then advanced to fill the defect and the outer skin incision is purse-stringed resulting in circumareolar scar.

Minimising the cavity and designing it to collapse in a radial direction around the NAC should be planned. Releasing the breast either in the subcutaneous plane or from the chest wall allows good mobility and filling of the tumour cavity. Dissected both planes, i.e. in front of gland and behind should be avoided as this increases the risk of fat necrosis.

### Therapeutic mastopexy

Therapeutic mastopexies are indicated in small/medium sized breast with some degree of ptosis. This is predominantly a skin envelope tightening procedure achieving a 'breast lift' and the wide local excision is the only reduction that is performed. They are otherwise similar in technique to therapeutic mastopexy which is described below.

## Therapeutic mammoplasty

The design of pedicle depends on blood supply and it is therefore important to have good knowledge of this to maximise vascularity and minimise risk of fat, skin or nipple necrosis.

### Blood supply to the breast

The breast is a highly vascular organ which derives its blood supply from three principle sources<sup>25</sup>:

1. Internal Mammary Artery (IMA). It arises from the first part of the subclavian artery and travels along the lateral border of sternum. It gives branches which penetrate the intercostal muscles from 2<sup>nd</sup> to 5<sup>th</sup> intercostal spaces. It enters the breast and travels down until it divides into the musculophrenic and superior epigastric artery around the sixth intercostal space.  
IMA is the major blood supply contributing up to 60% supply to the breast through perforating branches (anterior rami mammarii) situated in the upper inner quadrant. Its second and third perforating branches are usually found at the breast meridian and are a source of supply to the superior and supero-medial pedicle. These are also a source of blood supply to the nipple and areola. A large musculocutaneous perforator (through the pectoralis major muscle) from either the fifth or sixth branch sustains the inferior or central based pedicle and is found just medial to the breast meridian about 2 to 4 cm above the infra-mammary fold.  
The fourth and fifth posterior intercostal perforators contribute to the inferior pedicle.
2. The lateral thoracic artery. It arises from the second part of the axillary artery between the subscapularis anteriorly and brachial plexus posteriorly and provides approximately 30% of blood supply to the breast. It follows the lower border of pectoralis minor supplying the serratus anterior and pectoralis muscles and also sends branches to the axillary nodes and subscapularis. It gives off an external mammary branch at the edge of pectoralis major to supply the lateral aspect of breast.
3. The Costocervical trunk. It arises from the second part of subclavian. The thoracic aorta also contributes to the blood supply of the breast via lateral branches of the posterior intercostal arteries.

There is extensive anastomoses between the above blood vessels providing a robust supply to the breast skin via subdermal plexus and the breast parenchyma.

### Pre-operative markings

The decision on pedicle selection depends on tumour location and marking for therapeutic mammoplasty are key steps in surgical planning. There are different ways of marking mammoplasty and the measurements vary according to the size of breast, the amount of reduction required and to ensure a generous WLE. Either a traditional vertical or Wise pattern skin reduction techniques can be used, but

unlike cosmetic breast reductions, minimising tension is of paramount importance in volume displacement techniques.

Main steps of marking include:

- Marking the cancer side first along with the identification of cancer either palpable or image guided.
- The patient is marked standing up.
- The midline is marked first from the suprasternal notch down to the umbilicus.
- The breast meridian is marked on the breast and continued onto the chest wall. This divides the breast volume into equal halves and does not always correspond with the nipple position. Generally it is found to be at the level of the midclavicular line.
- The level of the new nipple position varies depending on the patient's height, shape of the breast and the footprint of the breast. It is usually designed to be at the level of the inframammary fold.
- Neo-areola border is marked approximately 2cm above the nipple height.
- Two vertical lines are drawn down from the new nipple position to the breast meridian on the chest wall while moving the breast to each side ensuring that the vertical pillars will meet at the meridian without tension and ensuring an aesthetic breast shape. The length of these lines will vary depending on the size of the breast. Usually between 7-10 cm.
- The inferior line is drawn in the IMF and a line between the vertical pillars medially and laterally. This is drawn with enough length to avoid dog ear deformities during closure of the lower wound.
- Axillary surgery can be performed through the tail of Wise pattern mammoplasty or through second axillary incision depending on ease and tumour location.

Planning of the pedicles depends on the location of cancer. When the tumour lies in the expected area of resection for a standard breast reduction, no adaptation of technique is required (type A therapeutic mammoplasty).<sup>18</sup> However, when the tumour lies outside of the expected excision site, other modifications are required and may include use of an extended primary or secondary pedicle (type B therapeutic mammoplasty).<sup>18</sup>

The different therapeutic mammoplasty techniques can be based on the site of tumour.

### Inferior pole tumour

Superior or superio-medial pedicle allow resection of the inferior pole tumour with a Wise or vertical pattern reduction. J mammoplasty is useful for lower outer pole tumours. It avoids lateral retraction of the breast and deviation of the nipple- areola complex. It comprises a central and lateral breast flap, which is rotated towards the defect and the nipple-areola complex is re-positioned with a superior pedicle.

### Central tumours

Volume replacement techniques to correct central excisions often entail using an inferior advancement flap with a skin

paddle, but for high risk patients (smokers, those with diabetes, are very ptotic, have a high BMI and multiple comorbidities) more simple techniques such as the melon slice or wedge resections can be applied, which are very safe and simple techniques.

### Upper Pole tumours

Extended inferior or medial pedicles can be used to allow filling of the defect in the upper pole of the breast, although extending pedicles in general significantly increases the risk of fat necrosis. Conal rotation (whole breast plate) techniques avoid the use of pedicles and can be used to fill in defects in any quadrant, even the upper pole.

### Lateral tumours

Conal rotation techniques can be used for relatively small, but ptotic breasts, to fill lateral defects but for larger breasts, secondary pedicles (most often inferiorly based) are used. As a general rule, it is preferable to consider two short pedicles rather than one long pedicle to ensure a good vascular supply and decrease risk of fat necrosis. Pedicle choice ultimately depends on the vascularity and ease of rotation.

### Medial tumours

These can be challenging and surgery can be more complex. The principles remain the same as for lateral tumours. Care must be taken to preserve the breast tissue medial to the tumour to minimise disruption of the remaining breast.

### Conclusion

This review summarises the various volume displacement techniques that can be used to achieve an oncologically sound cancer resection with adequate margins and also give an acceptable cosmetic outcome.

Careful patient selection, addressing the modifiable risk factors, pre-operative planning and addressing patient expectations are all extremely important steps to a successful outcome in volume displacement techniques.

### Funding

This work has not received any funding.

### Confidentiality of data

As this paper is a review article, no patient care was affected and formal ethical approval was not required. We confirm that the work was performed to the best of our knowledge in the interest of patient care.

### Declaration of competing interest

The authors declare that they have no conflict of interest.

### Appendix. Access to oncoplastic videos.

#### Authorized by authors:

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