Review Article

# Long term effects of modern breast cancer surgery

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**Abstract:** Breast cancer surgery includes a wide array of surgical treatment options. Not only does it involve the oncologic excision of the breast cancer disease but it also involves the reconstruction of the breast. Surgical treatment options vary with regards to the size of the tumor relative to the size of the breast further complicated by the preferences of the patient and the ability of the available surgeon(s). The goal of this paper is to highlight major long-term effects, positive and negative, of modern breast cancer surgery.

**Keywords:** Oncoplastic surgery; breast cancer surgery; mastectomy; partial mastectomy; lumpectomy

Submitted Sep 12, 2017. Accepted for publication Oct 26, 2017.
doi: 10.21037/gs.2017.10.09
**View this article at:** http://dx.doi.org/10.21037/gs.2017.10.09

## Introduction

The primary goal of breast cancer surgery is to successfully remove the breast cancer from a patient. A secondary, and very important, goal is to reconstruct that patient so that the patient feels whole from a psychosocial perspective, with regards to self-perception or image and sexual well-being, and a functional perspective with regards to being able to wear a bra and feeling physically balanced especially in the setting of a mastectomy that by itself would possibly leave the patient with a heavier, imbalancing breast on the contralateral side. Both these goals are central to the surgical decision making of breast cancer treatment. The breast surgical oncologist assesses the options for cancer resection, be it with breast conservation or mastectomy, and the plastic surgeon recommends the appropriate reconstructive choices depending on whether breast conservation is chosen versus a mastectomy, on whether radiation is being planned as part of the adjuvant treatment, and on patient limitations and expectations. As such, long term effects for the patient depends heavily on reasonable surgical recommendations and will be discussed for specific oncologic and reconstructive surgical plans focusing on breast conservation and mastectomy.

## Breast conservation

### *Partial mastectomy alone*

Certainly, one of the most prevalent surgical options for early stage breast cancer, a partial mastectomy has the benefit of removing a smaller area of breast focused on the breast disease in that area without reconstruction. Often the cavity remaining is covered by the approximated dermis envelope which, assuming negative margins, is further treated with adjuvant radiation. Given that partial mastectomy alone is an art in which the surgical oncologist is charged to remove enough tissue so that the cancer is successfully excised but not too much so that the aesthetics of the breast form are maintained, a real positive margin rate of 20–40% is present that may lead to re-excision (1). As such, when more subsequent surgery is needed, it may lead to further compromise the breast architecture allowing scar to worsen the long-term effects of the breast. Furthermore, radiation to surgical cavities left after partial mastectomy alone may lead to further skin envelope collapse leading to poor aesthetics, breast asymmetry and decreased patient satisfaction (2). This is especially true if the original cancer partial mastectomy involves the inferior pole below the nipple areola complex where absent surgical

volume combined by scarring from surgery leads to long term nipple retraction inferiorly which is often referred to as the bird's beak deformity (3). Nevertheless, for small cancers, partial mastectomy alone is a very reasonable surgical option with low complication rates compared to mastectomy (4). But long term, slightly higher local-regional recurrence rates yet equivalent survival rates compared to mastectomy (5,6).

### *Partial mastectomy with volume displacement oncoplastic surgery*

A partial mastectomy combined with volume displacement oncoplastic surgery allows the breast surgical oncologist to remove a larger section of the breast and use reconstructive mastopexy or reduction mammoplasty designs to fill in the void created by this larger partial mastectomy. The removal of additional tissue compared to a partial mastectomy alone approach has the benefits of a lower positive margin rate of 10% (7,8) (compared to 20–40% in the partial mastectomy alone approach) (1), and long term improved aesthetic outcome using mastopexy/reduction mammaplasty designs (7,9-11). This is due to the re-arrangement of tissue using the mastopexy/reduction mammoplasty designs that obliterate any dead space preventing skin indentation or nipple retraction caused by adjuvant radiation that is seen in the partial mastectomy alone group. Often especially with large volume displacement oncoplastic surgery, there is a substantial rearrangement of tissue that elevates the nipple areola complex which is typical for a mastopexy design, and subsequently a contralateral symmetry mastopexy is performed (10). As expected, more surgery (compared to partial mastectomy alone) leads to higher short term post-operative complication rate of approximately 15–30% mostly involving small wound dehiscence at the T junction and seromas (12) Long term results with regards to a breast cancer survivor's self-image, psychosexual well-being have been excellent secondary to the mastopexy/reduction mammoplasty designs camouflaging the extensive partial mastectomy resections (13,14). Long term results with regards to local-regional recurrence and survival have been promising (7). Even with larger cancers, De Lorenzi *et al.* found that patients with large volume displacement oncoplastic surgery after a large partial mastectomy had no statistical difference in long term local-regional recurrence or overall survival when compared to a mastectomy group with similar characteristics (15).

### *Partial mastectomy with volume replacement oncoplastic surgery*

Particularly large cancers relative to breast size sometimes lead to a partial mastectomy resection of greater than 50% of breast volume (3,11). When this happens, local tissue rearrangement techniques employing volume displacement designs cannot accommodate for such a large resection and volume replacement options are necessary. Volume replacement oncoplastic surgery involves using local-regional flaps to supplement the lack of tissue present in the breast region after an extensive resection. Thoracodorsal or intercostal perforator flaps in addition to latissimus dorsi flaps are commonly used as options for volume replacement oncoplastic techniques. A contralateral symmetry mastopexy is often needed. Long term donor site morbidity when recruiting flap tissue is minimized when using perforator techniques that reduce tissue undermining resulting in less seroma formation especially when comparing it to the latissimus dorsi option. Long term oncologic outcomes are similar to volume displacement operations

## Mastectomy

### *Mastectomy alone*

Mastectomy alone can be a reasonable option for patients who cannot tolerate reconstruction secondary to having multiple medical co-morbidities. In general, reconstruction options should be discussed but those patients who are at significant increased risk and cannot tolerate prolonged surgery are candidates for mastectomy alone. Long term outcomes of mastectomy alone include poor aesthetics, breast asymmetry especially if a unilateral mastectomy is done. Mastectomies in general have a lower local-regional recurrence risk of approximately 3–5% compared to 8–10% when compared to regular partial mastectomy operations (5,6). Notably, there is no overall long-term survival difference between partial mastectomy and mastectomy treatment choices (5,6)

### *Mastectomy with implant reconstruction*

Implant reconstruction is the most common reconstructive option performed after a mastectomy (16). Reconstruction with implants can be performed in 1 or 2 stages with the 2-stage technique using a tissue expander to maintain or expand the breast skin envelope into which a permanent implant is placed as a second stage. If the skin envelope

 

is assessed to be of adequate size and condition during the initial mastectomy, then the reconstructive surgeon may place choose to perform a one stage direct to implant reconstruction understanding that these patients were highly likely to need additional revision surgery approximately at a later date (17). The anatomical placement of implants during reconstruction also varies by surgeon choice. Most common is a sub-pectoral placement with inferior pole support using a biologic mesh (18). This technique has the benefit of creating a larger pocket than a traditional sub-pectoral approach without biologic mesh leading to fewer expansions and less pain during expansions when a tissue expander 2-stage approach is employed (19,20). This larger pocket is also essential if a direct to implant 1-stage technique is used (21). Long term outcomes in placing the implant sub-pectoral include decreased capsular contracture secondary to the collagen fiber disruption with the pectoralis muscle movements over the implant (22). Unfortunately, animation deformities also occur because of the movement of the pectoralis muscle over the implant (23,24). The pre-pectoral implant placement technique is the newest approach for implant reconstruction after a mastectomy. Similar to the sub-pectoral approach, the pre-pectoral approach can be a 1- or 2-stage technique employing a tissue expander and then an implant when a 2-stage technique is chosen. Short term complications are similar to the sub-pectoral technique. By placing the implant above the pectoralis muscle, the pre-pectoral technique avoids the animation deformity seen with the sub-pectoral approach but no long-term data exists presently for this newer technique that theoretically may have a higher capsular contracture rate (23). Certainly, cost is higher for the pre-pectoral technique that requires additional biologic mesh to be used as a wrap around the implant relative to the sub-pectoral technique. Long term implant complications in general include capsular contracture and implant failure but in general patients are satisfied with this reconstruction option and would consider doing it again if given the choice. In the setting of radiation, long term implant reconstruction effects include a high rate of overall complications (60%) and a high rate of implant failure (30%) (25-27).

### *Mastectomy with autologous tissue reconstruction*

Autologous tissue reconstruction after a mastectomy can employ a wide array of tissue options. Most commonly, the abdominal tissue is used as the autologous donor and the reconstructive surgeon can choose from a pedicled flap transverse rectus abdominus myocutaneous flap (TRAM) option to a free flap deep inferior epigastric perforator (DIEP) or muscle sparing TRAM flap option. Autologous tissue is most often indicated when the mastectomy skin flap is radiated as it does not suffer any form of capsular contracture experienced by implant reconstruction. With abdominal tissue being used, long term donor site complications most often include a 1–5% hernia/abdominal bulge rate with higher rates for pedicled TRAM flap options versus free flap options (28,29). Long term patient satisfaction and aesthetic outcomes for reconstruction after mastectomy operations according to patient satisfaction scores belong to autologous tissue reconstruction when compared to implant reconstruction (30).

## Discussion

Each surgical treatment option for breast cancer has its share of long term benefits and disadvantages. Modern surgical techniques centered around oncoplastic surgery have increased breast conservation options and with improved oncoplastic techniques there has been an improvement in long term local regional recurrence rates, aesthetic outcomes while maintaining equivalent overall survival outcomes compared to mastectomy (3,10,11,15,31). Modern reconstruction after mastectomy has continued to employ either implant or flap techniques but the placement of implants in the pre-pectoral plane has similar short-term outcomes compared to the sub-pectoral implant placement but long-term outcomes are still unknown. From a cost-effectiveness perspective, preliminary studies have shown cost-effectiveness of oncoplastic surgery when compared to partial mastectomy alone or mastectomy with reconstruction (32). A major reason for this is for the clinical effectiveness seen with oncoplastic surgery even with the additional cost of adjuvant radiation (when compared to mastectomy and reconstruction). When comparing reconstructive options after mastectomy, flap operations may be more cost-effective but further research is needed in this area (33,34). In general, implant reconstruction does trend higher costs long term particularly because of capsular contracture complications. Overall, modern breast cancer surgery has improved long term outcomes with improved oncologic outcomes while expanding the indications for breast conservation (with oncoplastic surgery) with accompanied improved aesthetic outcomes.

## Conclusions

Modern breast surgery has expanded and improved long-term outcomes. Within breast conservation, oncoplastic surgery has improved in both oncologic and aesthetic outcomes while after mastectomy, the relatively newer pre-pectoral implant reconstruction approach aims to decrease long term animation defects seen with the traditional sub-pectoral approach.

## Acknowledgements

None.

## Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

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**Cite this article as:** Chatterjee A. Long term effects of modern breast cancer surgery. Gland Surg 2018;7(4):366-370. doi: 10.21037/gs.2017.10.09

 