Oncoplastic Techniques for Breast Conservation Surgery

33

Chin-Yau Chen, Kristine E. Calhoun, and Benjamin O. Anderson

Significance to Management of Breast Cancer

Formal techniques for breast conservation therapy are often not taught in general surgery programs with the same attention to detail as might be provided for training in performing an appendectomy, cholecystectomy, or other intraabdominal surgery. In a typical "lumpectomy," the skin is opened, the tumor removed, and the skin closed without any specific effort being made to close the lumpectomy defect. Indeed, closing the fibroglandular tissue can be problematic because unsightly defects can result if alignment of the breast tissue is suboptimal. Fibroglandular tissue that is sutured closed at middle depth in the breast while the patient is supine on the operating table can result in a dimpled, irregular appearance when the patient stands up. As a result, the standard teaching for breast conserving surgery is for the surgeon to close the skin without approximation of fibroglandular tissue, permit a seroma to form, and reabsorb over time, which can allow gravity help the breast tissue to heal naturally. An advantage to this approach is that the resulting seroma cavity can be used for balloon placement for partial breast radiation therapy.

While the simple "scoop and run" approach to lumpectomy can work well for small tumors, saucerization of the skin and/or displacement of the nipple–areolar complex (NAC) can result at final healing once the final seroma reabsorbs if the lesion that is removed from the breast is large. Large, segmentally distributed ductal carcinoma in situ (DCIS) that tracks toward the nipple may also make it difficult to avoid positive margins with the traditional lumpectomy, leading to subsequent re-excision or mastectomy. In addition, lumpectomy for centrally located cancer was not fully discussed in the initial design of lumpectomy, which resulted in overutilization of mastectomy in these patients (1). Several oncoplastic principles and techniques, while beneficial for improving the cosmetic outcome of breast conserving surgery, can also be very helpful in obtaining a wide surgical margin of resection. These fundamental oncoplastic techniques are easily taught to, and

B.O. Anderson (✉)
Professor of Surgery, Department of Surgery, Director, Breast Health Clinic, Chair and Director, Breast Global Health Initiative, University of Washington / Seattle Cancer Care Alliance, Fred Hutchinson Cancer Research Center, University of Washington, Seattle, WA, USA
e-mail: banderso@u.washington.edu

F.M. Dirbas and C.E.H. Scott-Conner (eds.), *Breast Surgical Techniques and Interdisciplinary Management*, DOI 10.1007/978-1-4419-6076-4_33,

used by, surgeons with experience in routine breast surgery. The concepts are technically straightforward and intuitively obvious once the basic principles are well understood (2).

Brief History/Background

For breast conservation to be effective, surgeons need to remove the cancer completely with adequate surgical margins while simultaneously maintaining the breast's shape and appearance (2, 3). Achieving both goals together at the same operation can be challenging depending upon the location of the tumor and the relative size of the breast. If the defect is large, such that there is a great deal of redundant skin over the defect, cosmetically unsatisfactory infolding can result as the skin adheres to the chest wall and the nipple deviates toward the lumpectomy site (2). In 1994, Werner P. Audretsch was one of the first to advocate for "onco-plastic surgery" for repair of partial mastectomy defects by combining the plastics technique of volume reduction with immediate flap reconstruction (4). Although initially used to describe the partial mastectomy combined with large myocutaneous flap reconstruction using the latissimus dorsi or the rectus abdominis muscles, the term oncoplastic surgery is now frequently used to describe a series of surgical approaches that utilize partial mastectomy and breast-flap advancement. These techniques are summarized in this chapter as parallelogram mastopexy lumpectomy, batwing mastopexy lumpectomy, donut mastopexy lumpectomy, reduction mastopexy lumpectomy, and central lumpectomy (2, 5).

Indications for Treatment

The indications for oncoplastic surgery are the same as those of traditional breast conserving surgery. Oncoplastic surgery has the additional benefit of resulting in uniformly wider margins around the cancer while at the same time preserving the shape of the breast. The techniques described in this chapter are those oncological resections that use breast-flap advancement (so called "tissue displacement techniques"). Compared to breast reconstruction using a myocutaneous flap, the breast-flap advancement technique is easily learned by breast surgeons, even those lacking formal plastic surgery training. In a review of 84 women who underwent partial mastectomy and radiation therapy, Kronowitz and colleagues showed that immediate repair of partial mastectomy defects with local tissues results in a lower risk of complications (23 vs. 67%) and better esthetic outcomes (57 vs. 33%) than that with a latissimus dorsi flap (6), which some surgeons have used for delayed reconstructions (7).

Required Preparative Studies

Breast MRI (magnetic resonance imaging) Mammography may underestimate the extent of DCIS by as much as 1–2 cm, especially when the fine-granular microcalcifications seen with well-differentiated DCIS are present (8). Because breast MRI uses gadolinium enhancement to highlight metabolically active tissues, cancers that are mammographically

occult may light up nicely on MRI. Compared with mammographic and ultrasound images, the extent of disease seen on MRI may correlate best with the extent of tumor found at pathologic evaluation. In addition, MRI has the lowest false negative rate in detecting invasive lobular carcinoma (9).

Of course, no imaging technique is perfect. Although its sensitivity is high, MRI has a low specificity of 67.7% in the diagnosis of breast cancer before biopsy (10). About a third of MRI studies will show some area of enhancement that needs further assessment but ultimately proves to be histologically benign breast tissue (2).

A consensus statement from the American Society of Breast Surgeons in 2005 supports the use of MRI for determining ipsilateral tumor extent or the presence of contralateral disease, in patients with a proven breast cancer (especially those with invasive lobular carcinoma), when dense breast tissue precludes an accurate mammographic assessment (11). For cancers containing both invasive and noninvasive components, a combination of imaging methods (mammography with magnification views, ultrasonography, and/or MRI) may yield the best estimate of overall tumor size (12).

Multiple bracketing wires. Hooked wires have been widely used for the preoperative localization for nonpalpable lesions, especially DCIS. In planning oncoplastic resections, the surgeon needs to accurately identify the area requiring resection. Silverstein and colleagues suggested the preoperative placement of 2–4 bracketing wires to delineate the boundaries of a single lesion (13). In a study by Liberman and colleagues, of 42 calcific lesions that were bracketed, complete removal of suspicious calcifications was accomplished in 34 (81.0%) of cases (14). It has been suggested that single wire localization of large breast lesions is more likely to result in positive margins, because the surgeon lacks landmarks to determine where the true boundaries of nonpalpable disease are located. This can be particularly problematic with large areas of mammographically detected DCIS where natural landmarks distinguishing normal and diseased tissue are lacking. Bracketing wires may assist the surgeon in achieving complete excision.

Description of Techniques

Parallelogram mastopexy lumpectomy (Fig. 33.1). This technique affords an easy approach for designing a skin incision that includes removal of a skin island that is located directly superficial to the area of known disease. The parallelogram shape of the skin island is

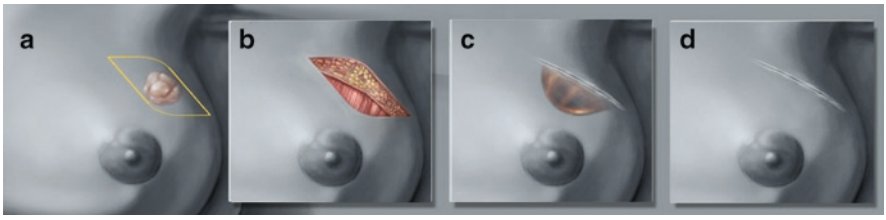

Fig. 33.1 Parallelogram mastopexy lumpectomy: (**a**) before incision. (**b**) After excision of the lesion. (**c**) After wound closure with seroma. (**d**) After seroma reabsorption

desirable, because it guarantees that the two skin edges that are reapproximated at closure will be equidistant. This approach is most commonly used for superior pole or lateral cancers, with the skin incision lines designed to follow Kraissl's lines, which track with the natural skin wrinkles and are generally oriented horizontally on the skin (15). By removing an island of skin, the parallelogram incision allows for greater glandular exposure than the typical curvilinear incision of the traditional lumpectomy. At the same time, the skin island excision avoids excessive, redundant skin being left behind after excision. The surgeon needs to be cautious when designing the skin ellipse, because an excessively broad island can cause substantial shifting of the NAC. A small amount of NAC shifting can create a cosmetically pleasing youthful lifting effect, but an excessive amount of shifting can cause the NAC to become abnormally superiorly located.

After incision of the skin island, a short distance of the skin flaps is raised along both sides of the wound. Dissection is then carried down to the chest wall and the breast is separated from the pectoralis muscle, with preservation of muscle fascia. A notable advantage to this posterior dissection of tissue is that it allows bimanual palpation of the target lesion to determine where the breast tissue should be divided (2). The breast tissue is undermined from the pectoralis muscle to mobilize two glandular flaps. The deepest parts of the breast glandular flaps are then brought together to close the defect, which is denoted by "mastopexy" (Fig. 33.2).

Batwing mastopexy lumpectomy (Fig. 33.3). For cancers adjacent or deep to the NAC, but without direct involvement of the nipple, lumpectomy can successfully be done without sacrifice of the nipple. The batwing approach preserves the viability of the NAC while preserving the breast mound by using mastopexy closure to close the resulting fibroglandular

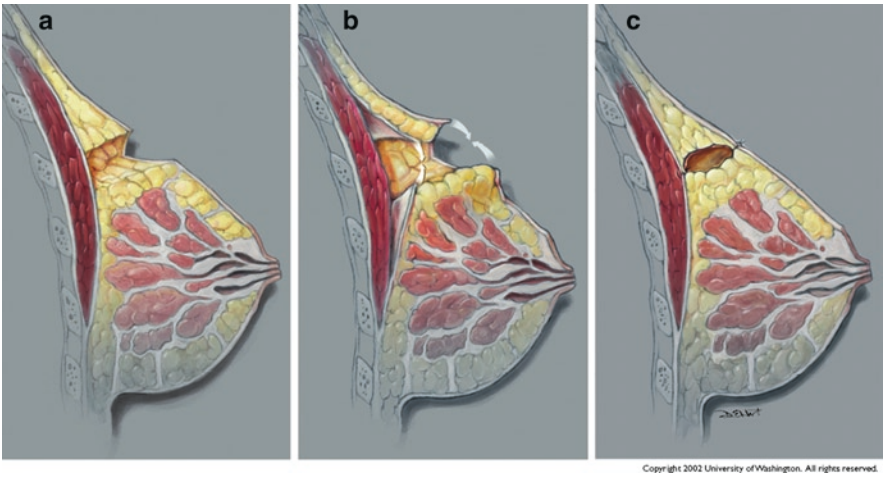

Fig. 33.2 Mastopexy closure. (**a**) The fibroglandular tissue is resected full-thickness from pectoralis fascia to skin, including an overlying skin island to allow proportional reduction in skin and fibroglandular tissue. (**b**) The fibroglandular tissue is elevated off of the pectoralis muscle to permit its advancement over the chest wall. The undermining of fibroglandular tissue at the pectoralis fascia permits breast tissue advancement over the muscle. (**c**) The fibroglandular tissue is closed at its deepest level. The skin is closed

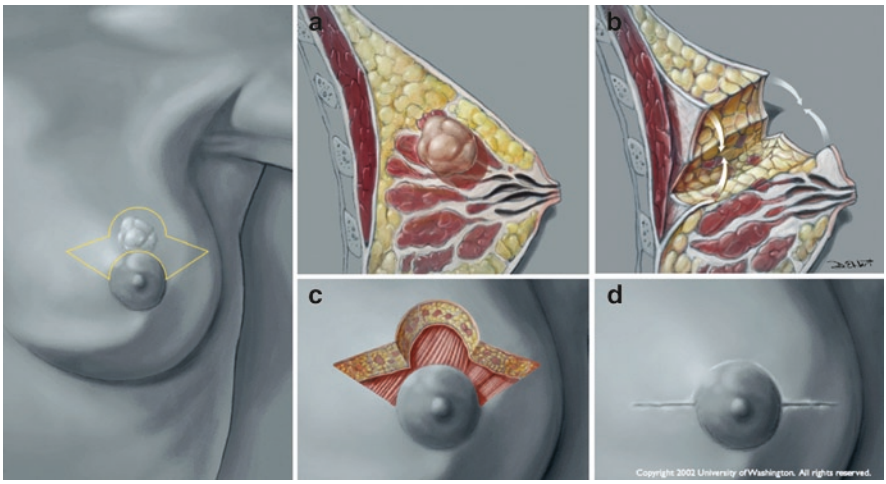

Fig. 33.3 The batwing mastopexy lumpectomy. (**a**) Preoperative view. (**b**) Two similar half-circle incisions are made with angled wings to each side of the areola and full-thickness excision is performed. (**c**) The remaining fibroglandular tissue is advanced to close the subsequent defect. (**d**) Final result at closure. This approach will cause some uplifting of the nipple, which may cause asymmetry relative to the contralateral breast

defect when the resection is full-thickness. This approach begins when two similar semicircle incisions are made with angled "wings" on each side of the areola. The two half-circles can be rotated based on the location of the tumor, with their "wings" rotated at the same time. Removal of the skin wings allows the two semicircles to be shifted together without creating redundant skin folds at closure. Dissection is then carried deep to the known cancer. When the resection is carried full-thickness to the chest wall, some mobilization of the fibroglandular tissue for mastopexy closure may be required, which should be performed as with the parallelogram mastopexy lumpectomy. In cases where the breast is moderately large and the cancer is superficial, a full-thickness resection to the chest wall may not be necessary and mastopexy can be omitted. This procedure can cause some lifting of the nipple into the upper breast and a contralateral lift may need to be performed to achieve symmetry.

Donut mastopexy lumpectomy (Fig. 33.4) For segmentally distributed cancers that are located in the upper or lateral breast, the donut mastopexy lumpectomy can be used to achieve effective resection of long, but narrow segments, of breast tissue. The donut mastopexy avoids a visible long radial scar which is against the Kraissl's line or Langer's line. In this procedure, two concentric lines are placed around the areola and a periareolar "donut" skin island is excised. Deepithelialization, by separating this skin island from the underlying tissues, is carefully performed. The skin envelope overlying the fibroglandular tissue is elevated in a fashion similar to that used for a skin-sparing mastectomy. The quadrant of breast tissue that includes the target lesion is fully exposed by delivering that portion of breast tissue through the periareolar incision, then separating it in a full-thickness fashion from the underlying pectoralis muscle. The segment of breast tissue is then resected in a wedge-shaped fashion. The two sides of fibroglandular tissue are then approximated as

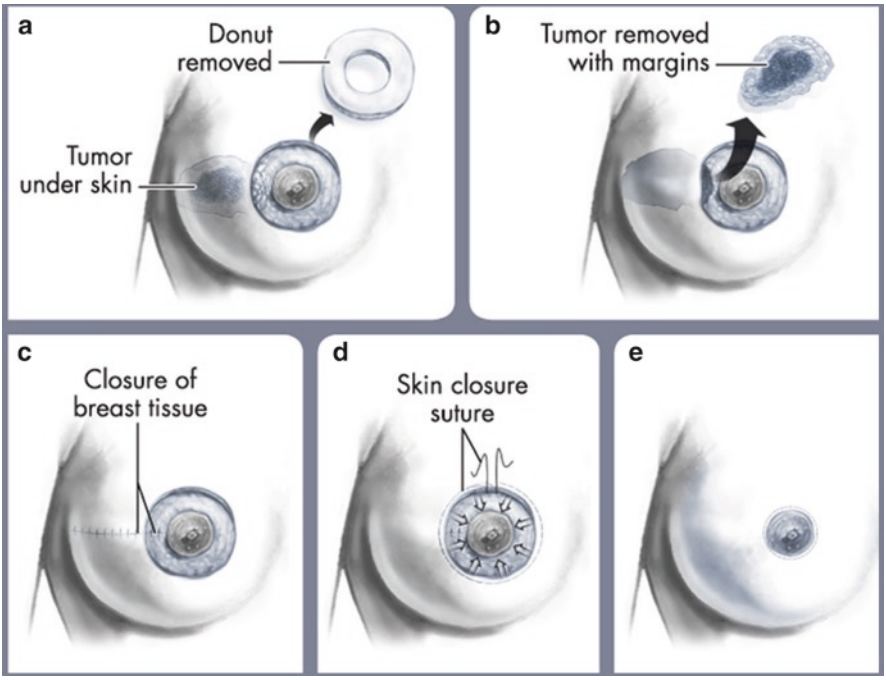

Fig. 33.4 Donut mastopexy lumpectomy. (**a**) Periareolar deepithelialization. (**b**) Segmental resection of tumor. (**c**) Mastopexy closure. (**d**) Purse-string skin closure. (**e**) Postoperative result

they are returned to their natural location inside the breast. A purse-string suture is placed around the areola opening and the periareolar skin incision is closed in standard fashion. Only a periareolar scar will be visible after this operation.

Reduction mastopexy lumpectomy (Fig. 33.5). Initially used in women with macromastia and excessive breast ptosis, this procedure can be used for resection of lesions in the lower hemisphere of the breast between the 4 o'clock to 8 o'clock positions. For cancers in the lower pole of the breast, traditional lumpectomy using circumareolar incision can cause cosmetically unacceptable downturning of the nipple due to scar contracture after radiotherapy. This unpleasant outcome can be prevented by using the technique of reduction mastopexy lumpectomy. In this procedure, a reduction mammoplasty keyhole pattern incision is made. The skin above the areola is deepithelialized and a superior pedicle flap is created through an inframammary incision. Wide undermining of the breast tissue off the pectoral fascia is then used to mobilize the NAC. Mobilization of the breast tissue allows palpation of both the deep and superficial surfaces of the tumor, which can aid the surgeon in determining the lateral margins of excision around the lesion. Recentralization of the NAC is then performed. The medial and lateral flaps are undermined and sutured together to fill the resulting defect, leaving a typical inverted-T scar. If desired, a contralateral lift can be performed afterwards to achieve symmetry.

Central lumpectomy (Fig. 33.6). For cancers involving the NAC, or for Paget's disease of the nipple, the cosmetic impact of a central lumpectomy and nipple removal likely

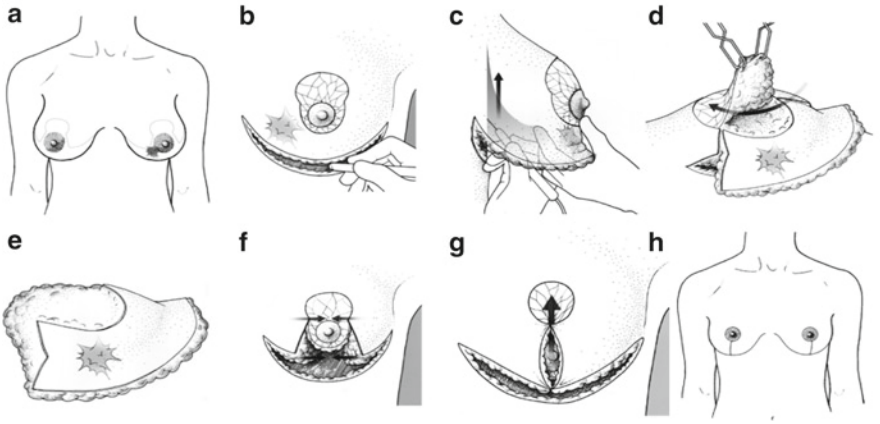

Fig. 33.5 Reduction mastopexy lumpectomy: (**a**) Preoperative skin markings done in the upright position, showing tumor location and *dotted line* for skin incision. (**b**) The area surrounding the nipple–areolar complex (NAC) deepithelialized and the inframammary skin incision. (**c**) Undermining the breast off the pectoral fascia and palpation of the tumor. (**d**) Developing the superiorly based flap for the NAC. (**e**) Excised tissue consisting of en bloc specimen. (**f**) The residual defect. *Arrows* indicate apposition of medial and lateral pillars of gland. (**g**) Reshaping the breast. *Arrow* indicates relocation of NAC to the deepithelialized area. (**h**) Reshaping the breast. *Arrow* indicates relocation of NAC to the deepithelialized area (21)

Fig. 33.6 Central lumpectomy. (**a**) Large parallelogram incision encompassing the NAC. (**b**) Excision of lesion. (**c**) Final skin closure

accounts for the common use of mastectomy in this situation. While central lumpectomy removes the NAC and underlying central tissues, it leaves behind a significant breast mound. The cosmetic outcome with central lumpectomy can range from good to outstanding, depending on the woman's body habitus, and is likely to be better tolerated than reconstruction of an entire breast (2). The central lumpectomy can be particularly valuable in women with large breasts where loss of the entire breast with mastectomy may create prominent asymmetry. For patients so inclined, a subsequent nipple–areolar reconstruction can be performed for cosmetic purposes (16). In central lumpectomy, the incision can be made in the pattern of a large parallelogram, which encompasses the entire NAC. The operative procedures and principles are the same as those of the parallelogram mastopexy lumpectomy. Mastopexy closure is performed as needed.

Complications, Pitfalls, and Solutions

When using oncoplastic approaches, surgeons without formal plastic surgery training must determine which procedures they are comfortable performing without plastic surgery consultation or intraoperative collaboration (2). Wound infection, fat necrosis, and delayed healing of T-junctions in the reduction mastopexy lumpectomy are all potential complications (17). The blood supply of the external nipple arises from underlying fibroglandular tissue using major lactiferous sinuses rather than the collateral circulation from surrounding areolar skin, so nipple necrosis may occur if dissection extends high up behind the nipple (2).

If re-excision is needed for positive surgical margins following the initial resection, both the surgical approach and timing of the operation must be considered (2). In most instances, use of the same incision is feasible. In some situations, a new incision may be technically advantageous by allowing time for healing of the previous excision. When the positive margin involves only a minority of the specimen, the entire biopsy cavity does not need re-excision. Instead, only the one or two involved margins of the previous biopsy cavity need be taken. When all the margins are positive, mastectomy may be needed to attain satisfactory surgical clearance. In this instance, it may be technically challenging to include both the initial oncoplastic incision and the NAC in a subsequent total mastectomy. If re-excision is delayed for 3–4 weeks, the previous seroma cavity may be nearly reabsorbed, which leaves a fibrous biopsy cavity that can be easily located by intraoperative palpation. With noninvasive cancer, Dr. Silverstein has suggested that it is feasible to delay re-excision for up to 3 months, at which point the seroma cavity has been fully reabsorbed (13).

New Developments/Clinical Trials on the Horizon

In 2005, Kaur and colleagues reported a nonrandomized comparative analysis of 30 consecutive patients who underwent oncoplastic partial mastectomies and 30 consecutive patients who underwent standard breast excisions (18). They observed that negative margins (>2 mm) were achieved in 83% of the oncoplastic surgery resections, but in only 57% of the standard resections. The mean volume of the excised specimens was significantly

higher in the oncoplastic surgery group (200 vs. 118 cm^3). Similar results were reported by other authors in 2006 (19).

While encouraging results regarding negative margin rates and larger resection volumes have been reported with oncoplastic surgical resections, intermediate follow-up of outcomes varies from study to study, and long-term follow-up results are still lacking. One review by Asgeirsson and colleagues reported their intermediate follow-up (up to 4.5 years), with local recurrence rates that varied from 0 to 1.8% per year (20). Future studies to assess long-term local recurrence rates in oncoplastic surgery at 5–10 years will be helpful to confirm the durability of these approaches for the resection of larger cancers (21).

References

1. Chen CY, Sun LM, Anderson BO. Paget disease of the breast: Changing patterns of incidence, clinical presentation, and treatment in the U.S. Cancer. 2006;107(7):1448–58.
2. Anderson BO, Masetti R, Silverstein MJ. Oncoplastic approaches to partial mastectomy: an overview of volume-displacement techniques. Lancet Oncol. 2005;6(3):145–57.
3. Masetti R, Pirulli PG, Magno S, Franceschini G, Chiesa F, Antinori A. Oncoplastic techniques in the conservative surgical treatment of breast cancer. Breast Cancer. 2000;7(4):276–80.
4. Audretsch WP. Reconstruction of the partial mastectomy defect: classification and method. In: Spear SL, editor. Surgery of the breast: principle and art. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2006. p. 179–216.
5. Chen CY, Calhoun KE, Masetti R, Anderson BO. Oncoplastic breast conserving surgery: a renaissance of anatomically-based surgical technique. Minerva Chir. 2006;61(5):421–34.
6. Kronowitz SJ, Feledy JA, Hunt KK, Kuerer HM, Youssef A, Koutz CA, et al. Determining the optimal approach to breast reconstruction after partial mastectomy. Plast Reconstr Surg. 2006;117(1):1–11.
7. Nahabedian MY. Determining the optimal approach to breast reconstruction after partial mastectomy: discussion. Plast Reconstr Surg. 2006;117(1):12–4.
8. Holland R, Faverly DRG. The local distribution of ductal carcinoma in situ of the breast: whole-organ studies. In: Silverstein MJ, editor. Ductal carcinoma in situ of the breast. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2002. p. 240–54.
9. Boetes C, Veltman J, van Die L, Bult P, Wobbes T, Barentsz JO. The role of MRI in invasive lobular carcinoma. Breast Cancer Res Treat. 2004;86(1):31–7.
10. Bluemke DA, Gatsonis CA, Chen MH, DeAngelis GA, DeBruhl N, Harms S, et al. Magnetic resonance imaging of the breast prior to biopsy. JAMA. 2004;292(22):2735–42.
11. Dardik A. Use of magnetic resonance imaging in breast oncology. J Am Coll Surg. 2005; 200(5):742.
12. Silverstein MJ, Lagios MD, Recht A, Allred DC, Harms SE, Holland R, et al. Image-detected breast cancer: state of the art diagnosis and treatment. J Am Coll Surg. 2005;201(4):586–97.
13. Silverstein MJ, Larson L, Soni R, Nakamura S, Woo C, Colburn WJ, et al. Breast biopsy and oncoplastic surgery for the patient with ductal carcinoma in situ: surgical, pathologic, and radiologic issues. In: Silverstein MJ, editor. Ductal carcinoma in situ of the breast. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2002. p. 185–204.
14. Liberman L, Kaplan J, Van Zee KJ, Morris EA, LaTrenta LR, Abramson AF, et al. Bracketing wires for preoperative breast needle localization. AJR Am J Roentgenol. 2001;177(3): 565–72.
15. Kraissl CJ. The selection of appropriate lines for elective surgical incisions. Plast Reconstr Surg. 1951;8(1):1–28.

16. Jones JA, Pu LL. Oncoplastic approach to early breast cancer in women with macromastia. Ann Plast Surg. 2007;58(1):34–8.
17. Iwuagwu OC. Additional considerations in the application of oncoplastic approaches. Lancet Oncol. 2005;6(6):356.
18. Kaur N, Petit JY, Rietjens M, Maffini F, Luini A, Gatti G, et al. Comparative study of surgical margins in oncoplastic surgery and quadrantectomy in breast cancer. Ann Surg Oncol. 2005; 12(7):539–45.
19. Giacalone PL, Roger P, Dubon O, Gareh NE, Rihaoui S, Taourel P, et al. Comparative study of the accuracy of breast resection in oncoplastic surgery and quadrantectomy in breast cancer. Ann Surg Oncol. 2007;14:605–14.
20. Asgeirsson KS, Rasheed T, McCulley SJ, Macmillan RD. Oncological and cosmetic outcomes of oncoplastic breast conserving surgery. Eur J Surg Oncol. 2005;31(8):817–23.
21. Clough KB, Lewis JS, Couturaud B, Fitoussi A, Nos C, Falcou MC. Oncoplastic techniques allow extensive resections for breast-conserving therapy of breast carcinomas. Ann Surg. 2003;237(1):26–34.