

Breast reconstruction in conserving breast cancer surgery

Jamal K. Almasad, MD, FRCS.

ABSTRACT

تقترن الجراحة التحفظية لسرطان الثدي بالمعالجة الإشعاعية. وقد أثبتت بمرور الوقت أنها ناجحة من حيث ارتفاع نسبة الشفاء وقلّة الرجوع الموضعي لأورام الثدي. الجراحة التحفظية الناجحة هي التي تعني بإزالة كاملة للورم والمحافظة على شكل الثدي في آن معا. تبلغ نسبة السيدات الغير راضيات عن شكل الثدي بعد الجراحة التحفظية التقليدية ما بين 20% - 30%. هناك أساليب جراحية متعددة موصوفة بالأدبيات الطبية يتم استخدامها لزيادة عدد السيدات اللاتي يخضعن للمعالجة التحفظية والإبقاء على المظهر الجمالي للثدي، إضافة إلى إن تلك الأساليب الجراحية تمكن الجراح من إزالة جزء كبير من الثدي للحصول على حواف آمنة من الأنسجة المحيطة بالورم. إن تطور تقنية إزالة الورم بالطريقة التحفظية، وتطور نقل أنسجة الثدي من مكانها إلى المنطقة التي تعاني من نقص في الأنسجة نتيجة إزالة الورم قد أضافت بعدا مفيدا لجراحة الثدي التحفظية. كما إن استعمال مبادئ جراحة التجميل المختلفة كعملية تصغير الثدي، شد جلد الثدي، وعمليات أخرى تعنى بإزاحة أنسجة الثدي بطريقة فنية ومناقلة، وتطعيم الثدي بأنسجة محيطية ومجاورة، يعتبر ذو فائدة كبيرة لإصلاح وترميم شكل الثدي بعد العمليات التحفظية. على الرغم من أن معظم تلك المداخلات الجراحية ذات طابع بسيط، إلا أن بعض هذه العمليات تعتبر دقيقة ومعقدة مما يستلزم معرفة وخبرة كبيرة. وعليه، فإن الجراح الممارس لتلك العمليات يجب أن يكون على دراية كبيرة في تشريح وأمراض الثدي، والإجراءات التشخيصية الإشعاعية، حيث أن هذه الدراية تساعد على التخطيط سليم لتلك العمليات والحصول على أفضل النتائج. تهدف هذه المقالة إلى إلقاء الضوء على التقنيات الجراحية المختلفة والمستعملة في ترميم الثدي ومناقشة العوامل المؤثرة على تطبيقها.

Breast conserving treatment (BCT) combined with radiotherapy have proved the test of time as a sound oncological operation regarding survival and local recurrence. Successful BCT is a balance between adequate surgery and maintaining the breast's appearance. Unsatisfactory outcome reaches 20-30% in standard techniques of BCT. Concepts described to widen the spectrum of BCT, have made an improvement of cosmetic outcome, and facilitated a liberal safety margin. Volume displacement techniques, such as glandular flap, mammoplasty, donut mastopexy, and batwing mastopexy proved useful in large breasts and volume replacement, such as latissimus dorsi flap and local flaps are of great advantage to replace defects in small and medium sized breasts. Some of these techniques are simple, but comprehensive knowledge

and training are required for sophisticated ones. The objectives of this article are to shed light on different techniques adopted by surgeons to perform BCT in conjunction with various oncoplastic techniques and to discuss the factors that influence their applications to achieve best oncological and aesthetic outcome.

Saudi Med J 2008; Vol. 29 (11): 1548-1553

From the Department of Surgical Oncology, Jordan University Hospital, Amman, Jordan.

Received 13th April 2008. Accepted 6th August 2008.

Address correspondence and reprint request to: Dr. Jamal K. Almasad, Department of Surgical Oncology, Jordan University Hospital, Aljubaiba, PO Box 38, 11941 Amman, Jordan. Tel. +962 (795) 828283. Fax. +962 (6) 5355500. E-mail: jmasad@ju.edu.jo

Breast conserving treatment (BCT) combined with radiotherapy have proved the test of time as a sound oncological operation in terms of survival and local recurrence. Prospective randomized trials^{1,2} found no difference in local recurrence, disease-free interval, and long-term survival in the group using modified radical mastectomy compared to the BCT followed by whole breast irradiation.^{3,4} Successful breast conservation is a balance between surgical removal of cancer completely, with an adequate safety margin and maintaining the breast's shape and appearance. Preservation of body image, sensations of wellbeing, and positive psychological balance are added advantages to BCT. Unfortunately, 20-30% of patients have an unsatisfactory outcome, which could be attributed to excision of large volume in proportion of breast size,^{5,6} badly sited surgical incisions, poor tissue handling (fat necrosis and infection) and radiotherapy. The main objectives of this article are to shed light on different techniques adopted by surgeons to perform BCT in conjunction with various oncoplastic techniques, and the critical diagnostic and per operative planning to achieve best oncological and aesthetic outcome.

Standard techniques of conserving breast surgery. Quadrantectomy, as described by Veronesi et al,¹ involves the removal of the breast quadrant containing the tumor, together with overlying skin, and underlying pectoral fascia. A 2-3 cm rim of normal breast tissue around the

main tumor is removed. Quadrantectomy seems to be too radical, associated with substantial loss of breast volume and adverse cosmetic outcome, especially of the tumor outside the upper outer quadrant.⁷ Lumpectomy as described by Fisher et al,³ involves the removal of the main tumor with a 0.5-1 cm margin of normal breast tissue. Negative pathological margin is a prerequisite to avoid local recurrence. The surgery is usually followed by whole breast radiation to eradicate any sub clinical tumor foci in the affected breast.

Modification of standard techniques. In order to achieve satisfying cosmetic outcome from BCT, and at the same time abiding to the principles of oncological surgery to maximize the local control, surgeons attempted to improve the surgical techniques.⁸ For full thickness excision of the tumor bearing area extending down to pectoral fascia and including the overlying skin to avoid the problem of fixation of the skin to the underlying fascia, some authors recommended dissection of the glandular plate from the underlying pectoralis muscle and fascia, which facilitates a proper contouring and easy obliteration of the dead space at tumor bed. The use of suitable incisions to be curvilinear or transverse in the upper half of the breast and radial incisions in the lower half of the breast claimed to improve the cosmetic outcome.^{8,9}

Basic principles for oncoplastic surgeons. Surgeons should appreciate the impact of breast shape on the surgical planning, the breast may rounded, and conical in young ladies, the upper half will change from being convex to concave shape with time due to the gravity effect. Tubular breasts are not uncommon. The breast size has an impact on planning oncoplastic techniques, the large breast may be more suitable for reduction techniques, while women who have small breasts will benefit from additive surgery. Tumor size was a significant variable in BCT, most of early studies recommended conserving surgery for small tumors of 2 cm or less,^{1,3} such limitation was criticized by other studies, which upgrade the allowable size to 5 cm.^{10,11} In fact, the tumor size in relation to the breast volume is more decisive than the absolute tumor volume.¹² Oncoplastic techniques allow excision of large tumor as long as an adequate safety margin can be achieved and the resulting defect can be managed with reasonable outcome.¹³ The location of the tumor requires critical understanding; the classical division into 4 or 5 quadrants are inappropriate for precise planning, dividing the breast in 9 zones is more convenient¹⁴ for selection of suitable surgical intervention. Localization and distribution of the breast tumor within the breast are of extreme importance for adequate excision of the tumors with safety margin. The study carried out by Holland et al,¹⁵ revealed 55% of tumors were localized, while 35% had segmental distribution and the remaining are irregularly

extended. In the localized type, safety margin can be achieved easily, while segmentally distributed tumors demand excision of the whole segment with subsequent larger defects. Irregularly distributed tumors require mastectomy in most cases. Breast clinical examination is helpful to excise breast tumors of localized type, but it has limited value in segmentally distributed tumors. Mammography and ultrasonography are routinely used in daily practice to predict the orientation and the extent of the tumor within the breast, but its value is low in determining the distribution of non-invasive components.¹⁵ Magnetic resonance imaging (MRI) is used more frequently in measuring the extent of breast tumors especially in dense breasts.¹⁶ The accuracy of MRI was higher compared with that of mammography and sonography for assessment of size and extent of breast tumors. Although data regarding MRI are encouraging, an important limitation of MRI is its high rate of false-positive results.¹⁷ Three dimensional CT scan and PET-CT may play a significant role in precise localization of the tumors, but more evidence is required.¹⁸

Volume displacement oncoplastic procedures:
Reduction mammoplasty for lumpectomy. Surgeons experienced in various forms of reduction mammoplasty have unrestricted ability to widely excise breast cancer with a sufficient safety margin if the tumor could be included within the resected specimen. Lower central tumors can be excised by using a superior pedicle technique, while tumors located lower lateral and those located in the lower medial group can be dealt with using the inferior pedicle technique of reduction mammoplasty.^{19,20} Several modifications of mammoplasty techniques allow resection of tumors even located outside the proposed area of resection in conventional superior or inferior pedicle techniques.¹⁴ Reduction mammoplasty usually demands a skilful surgeon, reduction in the contra lateral breast makes the procedure of longer duration, more cost and more liable for complications.¹³ If further surgery due to involved margin or multicentricity is required, mastectomy may be difficult to include mammoplasty scars.¹³ Postoperative radiation may pose a challenge for the whole breast radiation and booster radiation to the tumor bed.²¹ Women who have had cosmetic reduction mammoplasty had shown lower risk of subsequent breast cancer.²² Therefore, reduction mammoplasty may reduce the risk of cancer in the treated contra lateral breast.

Donut mastopexy lumpectomy. Donut mastopexy is originally described to correct a protuberant nipple-areola complex (NAC) and mild ptosis, especially in tubular breast.²³ A donut-shaped portion of periareolar skin is de-epithelized. The radius of the skin to be removed is usually 2-3 cm and includes a portion of the areola when it is of large diameter. The resulting

wound is closed by a purse-string closure around the nipple, leaving only a periareolar closure at the end of the operation (Figure 1). The main advantages of such a procedure were minimizing scar of periareolar area, preservation of nipple sensation, easy to perform, and short duration of surgery.²⁴ Donut mastopexy was integrated as an excellent approach to excise malignant lesions of the breast, in fact one can consider this approach as a midline incision to explore the abdominal cavity since different parts of the breast can be reached without difficulty. This technique is usually suitable for

tumors segmentally distributed in the upper lateral or upper central locations and deeply seated in the breast away from the skin. If a large piece of glandular tissue was excised leaving redundant skin and underlying tissue hanging in the dead space as a result of large volume resection, the skin can be de-epithelized and buried to fill the dead space (Figure 2). It is occasionally feasible to approach the axilla through the same incision when the tumor is in the upper lateral location. Donut mastopexy lumpectomy allows surgeons to perform classical or skin sparing mastectomy (if an adequate margin could

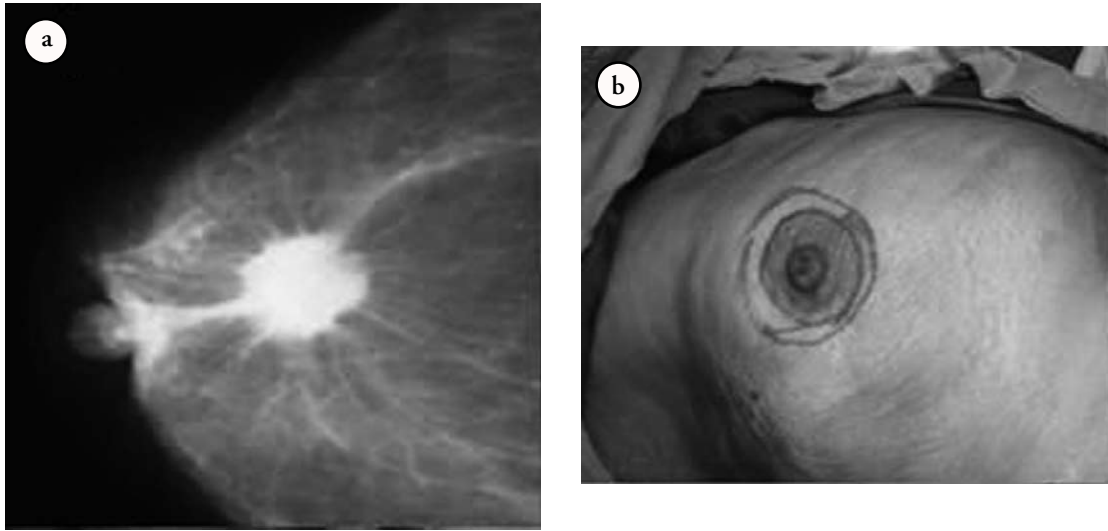


Figure 1 - Donut mastopexy lumpectomy showing a) Mammographic location of the tumor, b) periareolar marking.

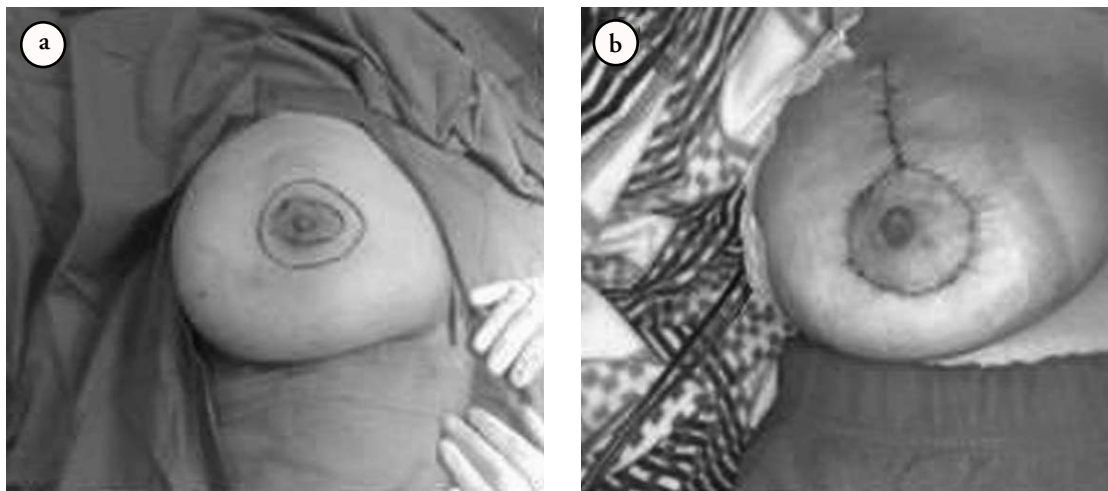


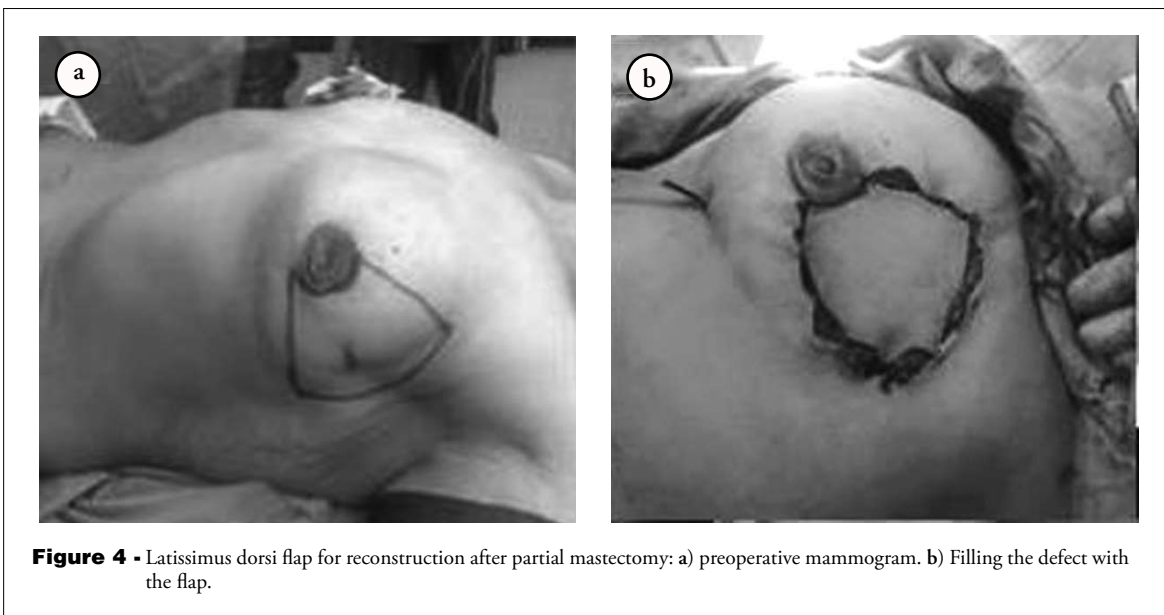
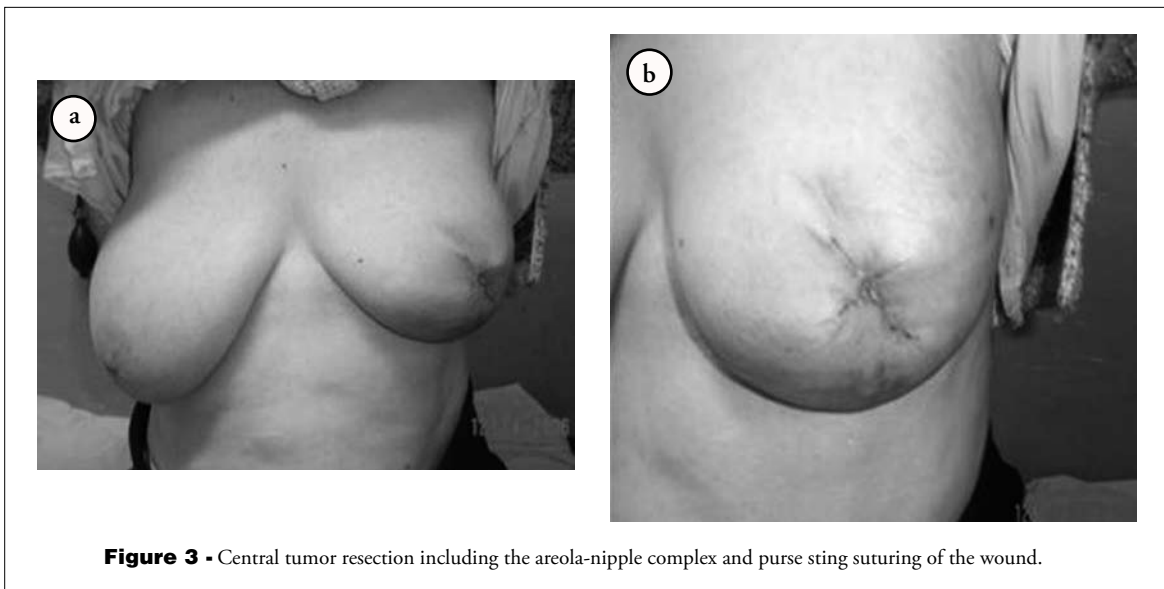
Figure 2 - Donut mastopexy lumpectomy a) periareolar marking: The radially closed wound as a result of deepithelization of redundant skin, which was buried to fill the dead space. b) Results in the early postoperative period.

be achieved by BCT without leaving a violated previous skin incisions.

Batwing mastopexy lumpectomy. “Batwing” mastopexy can be considered for cancers located centrally and above the NAC, but not directly infiltrating the major ducts. Two similar half-circle incisions are made with angled wings to each side of the areola the tumor should be excised with safety margin and the fibroglandular tissue, incontinuity with NAC is advanced to close the subsequent defect. Adequate removal of skin overlying the lesion could improve local control of cancers located superficially. Nipple necrosis

may take place if dissection extends directly behind the nipple.²⁵ Patients with pendulous breasts are particularly eligible for this procedure, which can also be applied to the contra lateral breast to achieve symmetry.

Central lumpectomy. In this technique, the nipple-areola complex is circumferentially excised at the areola-skin junction as the superficial margin of tumors located immediately or involve the areola-nipple complex. The skin and the wound is closed in a transverse fashion or with a purse-string suture as preferred (Figure 3), with immediate or delayed reconstruction of the areola-nipple complex.²⁶⁻²⁸



Volume replacement: Latissimus dorsi flap (LD).

Latissimus dorsi flap started to be used to fill and cover large defects after BCT since the 1990s.^{29,30} Techniques of rising the flap were described by several authors,²⁹⁻³¹ the procedure may be performed immediately to compensate for the resulting defect or at a later stage.^{29,31} This flap is an excellent option in women with large tumor of moderate or small size breast, where an additive procedure is required or mastectomy otherwise. A mini LD is usually sufficient and can be raised with less morbidity and good cosmetic outcome following the procedure.³⁰⁻³² The latissimus dorsi flap is mainly used for defects in the lateral half of the breast, but practically can be used to fill defects in any part of the breast, but skin color miss match, donor site morbidity and position change during operation are known disadvantages (Figure 4).

Local flaps (LF). We mean the use of juxta skin and its underlying soft tissue with or without glandular tissue to fill and cover defects in the upper lateral and upper central segments of the breast after conserving surgery for breast cancer. The LF is a promising procedure to compensate for large defects in small and medium sized breasts. The technique as described elsewhere³³ is simply summarized as in Figure 5, the pre operative and intra operative marking and planning are essential (Figure 5a).

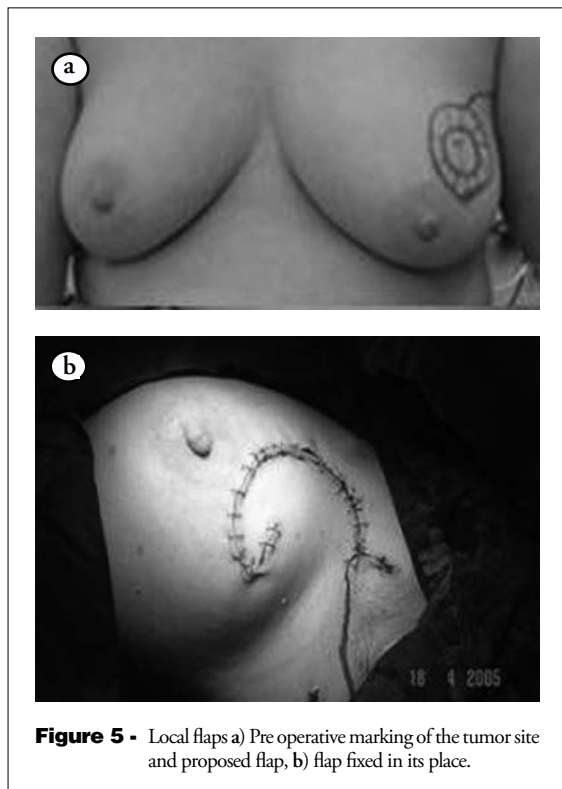


Figure 5 - Local flaps a) Pre operative marking of the tumor site and proposed flap, b) flap fixed in its place.

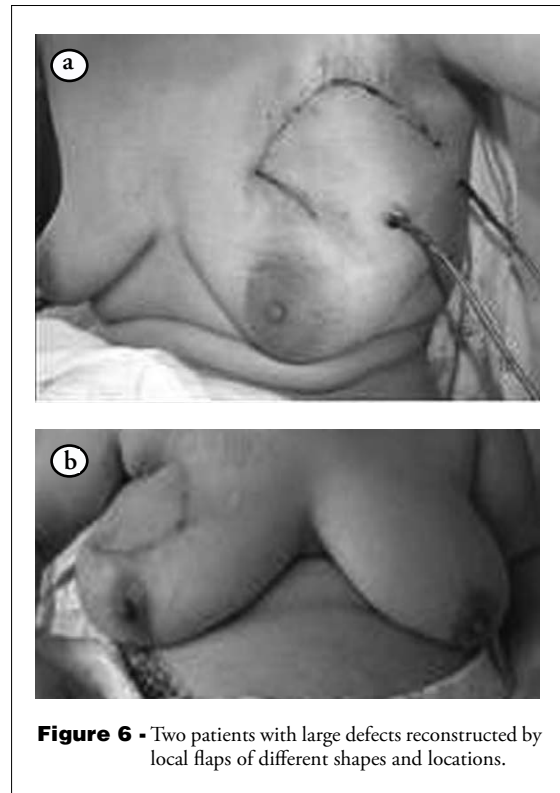


Figure 6 - Two patients with large defects reconstructed by local flaps of different shapes and locations.

While waiting the results of frozen section, the site of incision for access to axilla is marked below the axillary hair line or even at a lower level to be the upper boundary of the designed local flap. A composite of tissue between the upper or lateral border of the post surgical defect and axillary incision are raised after making a third incision to communicate the previous 2 incisions. The flap is usually composed of skin and subcutaneous tissue in case of upper outer quadrant defects, while in upper central defects, glandular tissue is incorporated in the flap. Raising the flap will provide very wide access to the axilla, which greatly facilitates axillary dissection. This option of reconstruction is infrequently described in the literature.³³⁻³⁶ A report of 25 cases with extended follow up, local recurrence was 8%, cosmetic was very good, and good in 84% of women in the study with no poor aesthetic outcome (Figure 6). Local flaps is an added assets to other oncoplastic procedures, but supportive studies are required in the future.

In conclusion, in the last 2 decades, the spectrum of conserving breast surgery has been widened by incorporating various oncoplastic techniques in the management of breast cancer. These procedures have a definite positive impact on aesthetic outcome, are oncologically sound and provide an opportunity for more women to live with 2 breasts. Many of these

techniques can be easily learned and practiced, special training and expertise are required for some techniques. In the future, the results of the reunion of plastic surgery with surgical oncology will produce competent breast surgeons who will routinely practice these techniques with more favorable outcome.

References

- Veronesi U, Luini A, Galimberti V, Stefano Z. Conservation approaches for the management of stage I/II carcinoma of the breast: Milan Cancer Institute trials. *World J Surg* 1994; 18: 70-75.
- Veronesi U, Cascinelli N, Mariani L, Greco M, Saccozzi R, Luini A, et al. Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. *N Engl J Med* 2002; 347: 1227-1232.
- Fisher B, Anderson S, Bryant J, Margolese R, Deutsch M, Fisher E, et al. Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. *N Engl J Med* 2002; 347: 1233-1241.
- Clough K, Kroll S, Audretsch W. An Approach to the Repair of Partial Mastectomy Defects. *Plast Reconstr Surg* 1999; 104: 409-420.
- Clough K, Cuminet J, Fitoussi A, Nos C, Mosseri V. Cosmetic sequelae after conservative treatment for breast cancer: classification and results of surgical correction. *Breast Cancer* 2005; 12: 16-20.
- Al-Ghazal SK, Blamey RW. Cosmetic assessment of breast conserving surgery for primary breast cancer. *Breast* 1999; 8: 162-168.
- Veronesi U, Zurrida S. Optimal Surgical Treatment of Breast Cancer. *Oncologist* 1996; 1: 340-346.
- Goodson WH 3rd. Closure of partial mastectomy. *Am J Surg* 2006; 191: 117-120.
- Anderson BO, Masetti R, Silverstein MJ. Oncoplastic approaches to partial mastectomy: an overview of volume-displacement techniques. *Lancet Oncol* 2005; 6: 145-157.
- van Dongen JA, Voogd AC, Fentiman IS, LeGrand C, Sylvester RJ, Tong D, et al. Long-term results of a randomized trial comparing breast-conserving therapy with mastectomy: European Organization for Research and Treatment of Cancer 10801 trial. *J Natl Cancer Inst* 2000; 92: 1143-1150.
- Jacobson J, Danforth D, Cowan K, d'Angelo T, Steinberg S, Pierce L, et al. Ten-year results of a comparison of conservation with mastectomy in the treatment of stage I and II breast cancer. *N Engl J Med* 1995; 332: 907-911.
- Berrino P, Campora E, Santi P. Postquadrantectomy breast deformities: classification and techniques of surgical correction. *Plast Reconstr Surg* 1987; 79: 567-572.
- Clough K, Lewis J, Couturaud B, Fitoussi A, Nos C, Falcou M. Oncoplastic Techniques Allow Extensive Resections for Breast-Conserving Therapy of Breast Carcinomas. *Ann Surg* 2003; 237: 26-34.
- McCulley S, Macmillan R. Planning and use of therapeutic mammoplasty Nottingham approach. *Br J Plast Surg* 2005; 58: 889-901.
- Holland R, Hendriks JH, Vebeek AL, Mravunac M, Schuurmans Stekhoven JH. Extent, distribution, and mammographic/histological correlations of breast ductal carcinoma in situ. *Lancet* 1990; 335: 519-522.
- Hata T, Takahashi H, Watanabe K, Takahashi M, Taguchi K, Itoh T, et al. Magnetic resonance imaging for preoperative evaluation of breast cancer: A comparative study with mammography and ultrasonography. *J Am Coll Surg* 2004; 198: 190-197.
- Carlson RH. Breast Cancer: Preop MRI Aids Surgical Decision-Making. *Oncology Times* 2004; 26: 37-43.
- Bradbury J. Better characterisation of breast lesions. *Lancet Oncol* 2006; 7: 538.
- Wallace AM, Comstock C, Hoh CK, Vera DR. Breast imaging: a surgeon's prospective. *Nucl Med Biol* 2005; 32: 781-792.
- Caruso F, Catanuto G, De Meo L, Ferrara M, Gallodoro A, Petrolito E. Outcomes of bilateral mammoplasty for early stage breast cancer. *Eur J Surg Oncol* 2008; 34: 1143-1147.
- Munhoz A, Filassi J, Aldrighi C, Ricci M, Martella E, de Barros A, et al. Bilateral reduction mammoplasty for immediate breast conservation surgery reconstruction and intraoperative radiotherapy: a preliminary report. *Aesthetic Plast Surg* 2007; 31: 94-100.
- Elund T, Gannett D. A single isocenter technique using CT based planning in the treatment of breast cancer. *Med Dosim* 1999; 24: 239-245.
- Boice J, Persson I, Brinton L, Hober M, McLaughlin J, Blot W, et al. Breast cancer following breast reduction surgery in Sweden. *Plast Reconstr Surg* 2000; 106: 755-762.
- Benelli L. A new periareolar mammoplasty: The "round block" technique. *Aesthetic Plast Surg* 1990; 14: 93-100.
- Gruber R, Jones H. The "donut" mastopexy: indications and complications. *J Plast Reconstr Surg* 1980; 65: 34-38.
- Anderson B, Masetti R, Silverstein M. Oncoplastic approaches to partial mastectomy: an overview of volume-displacement techniques. *Lancet Oncol* 2005; 6: 145-157.
- Fitzal F, Gnant M. Breast conservation: evolution of surgical strategies. *Breast J* 2006; 12: S165-S173.
- Carty H, McCullough P, Aluwihare N, Matey P. Breast conserving surgery for breast cancer involving the nipple. *Breast* 2008; 17: 107-110.
- Noguchi M, Taniya T, Miyazaki I, Saito Y. Immediate transposition of a latissimus dorsi muscle for correcting a post quadrantectomy breast deformity in Japanese patients. *Int Surg* 1990; 75: 166-170.
- Raja MAK, Straker VE, Rainsbury RM. Extending the role of breast-conserving surgery by immediate volume replacement. *Br J Surg* 1997; 84: 101-105.
- Dixon J, Venizelos B, Chan P. Latissimus dorsi mini-flap: a technique for extending breast conservation. *Breast* 2002; 11: 58-65.
- Rainsbury R. Breast conservation with latissimus dorsi mini flap: a new technique. *Eur J Surg Oncol* 1994; 20: 102-103.
- Almasad J, Salah B. Breast reconstruction by Local flaps after conserving surgery for breast cancer: an added asset to Oncoplastic techniques. *Breast J* 2008; [Epub ahead of print].
- Bold R, Kroll S, Baldwin B, Ross M, Singletary S. Local rotational flaps for breast conservation therapy as an alternative to mastectomy. *Breast Cancer* 1997; 4: 135-141.
- Takeda M, Ishida T, Ohnuki K, Suzuki A, Kiyohara H, Moriya T, et al. Breast conserving surgery with primary volume replacement using a lateral tissue flap. *Breast Cancer* 2005; 12: 16-24.
- Bogusevicius A. The defect of the breast managed by subaxillary flap after breast cancer removal. *Medicina (Kaunas)* 2003; 39: 985-989.