British Journal of Plastic Surgery (2005) **58**, 889–901

BJPS
An International Journal of Surgical Reconstruction
www.bjps.com

Planning and use of therapeutic mammoplasty—Nottingham approach☆

S.J. McCulley*, R.D. Macmillan

Breast Reconstruction Service, Departments of Plastic Surgery and Breast Surgery, Nottingham City Hospital, Hucknall Road, Nottingham NG5 1PB, UK

Received 4 July 2004; accepted 12 March 2005

KEYWORDS
Breast cancer;
Breast conserving surgery;
Reduction;
Mammaplasty;
Therapeutic mammaplasty

Summary Therapeutic mammaplasty, the use of reduction mammaplasty and radiotherapy to surgically treat breast cancer, is an established technique for selected breast cancers and can extend the role of breast conserving surgery. Most frequently described is the use of a wise pattern reduction for tumours that lie within the expected mammaplasty excision. However, mammaplasty techniques can be safely adapted to treat patients with cancers in all areas of the breast. An approach to selection and planning surgery is presented which has evolved from the experience of other units and our first 50 clinical cases over a 3-year period. The outcomes of these 50 cases are found in the accompanying article.

Technique will vary depending upon the tumour position. Breast cancers may lie within the normal excision site of a recognised mammaplasty method (scenario A) or outside of the expected excision sites (scenario B). In scenario A, a range of recognised techniques can be performed without adaptation to widely excise the tumour and re-shape the breasts. In scenario B the techniques need to be adapted. Three decisions are needed for planning in scenario B; the skin incision, the nipple-aereola complex (NAC) pedicle orientation and finally the method of filling the cancer defect. The latter can be achieved by either extending the nipple pedicle or by creating a secondary pedicle within the breast dissection. Either method will move tissue that is normally excised into the cancer defect. For central tumours an inferior pedicle is usually used to both fill the defect and re-create the nipple.

The long-term oncological safety of breast conserving surgery (BCS) and radiotherapy for selected women is accepted.[1] The frequency of its use has increased in recent years being more common than mastectomy as a treatment modality in most centres. For the majority of patients a good or excellent cosmetic outcome can be obtained.

☆A smaller version of this article was presented at the Winter BAPS meeting in 2003. This included the clinical outcomes of the first 20 patients. The clinical outcomes of the first 50 are now being prepared in a separate publication.

* Corresponding author. Address: Department of Plastic Surgery, Nottingham City Hospital, Hucknall Road, Nottingham NG5 1PB, UK. Tel.: +44 115 96 91169x46790; fax: +44 115 96 05216.
E-mail address: smcculle@ncht.trent.nhs.uk (S.J. McCulley).

S0007-1226/$ - see front matter © 2005 The British Association of Plastic Surgeons. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.bjps.2005.03.008

Predictors of poor outcome are tumour position,[2] especially medial and inferior tumours and the amount of breast tissue removed. As the proportion of breast removed increases so the chance of an acceptable cosmetic result decreases. Studies have suggested that depending on tumour site, removing more than 10–20% of the breast may risk an unsatisfactory cosmetic result.[2] This can be associated with poor psychological adjustment after breast cancer treatment.[3] Larger percentage excisions are more likely with larger tumours, smaller breast sizes and surgical preference or protocol for quandrantectomy. Many centres now advocate the use of oncoplastic techniques to help improve both the cosmetic and psychological outcomes in such cases. Oncoplastic techniques available are direct volume replacement with autologous tissue,[4,5] or breast reshaping by therapeutic mammaplasty or local-regional flaps.[6–12]

Breast reduction techniques have been used in the management of breast cancer since, the 1980'.[6] We prefer the term therapeutic mammaplasty as it avoids confusion over the indications and includes some variations of technique that are unique to the treatment of breast tumours. Clough et al. has described the largest series of 101 patients over 15-years and their findings support clinical and oncological safety.[7] However, the methods described mostly relate to its use in large breasted patients and using a wise pattern reduction to remove tumours that lie within the expected mammaplasty excision.[6–8] This is what we would describe as scenario A, where the tumour lies within the expected area of excision and no adaptation of technique is required. Losken described using different recognised pedicles for the nipple depending upon the tumour position.[13] He also discusses use of the pedicle to help fill the tumour excision site to improve contour. This enables many tumours to be excised without adapting a known method and highlights the advantage of understanding a range of recognised mammaplasty techniques.

When a tumour lies outside of the expected excision site of most recognised mammaplasty techniques (scenario B) other modifications to mammaplasty techniques are required. Descriptions of cases do exist to both replace parenchyma and/or skin in such scenarios.[14] These have usually involved the creation of secondary pedicles or extending the breast reduction pillar. By adding to these options and importantly defining these adaptations over the last 3-years we have found the planning of therapeutic mammoplasty is simplified and its indications extended.

Indications and advantages for therapeutic mammaplasty

The advantages are cosmetic and may also be oncological. The core role of therapeutic mammaplasty is to avoid poor cosmetic results from larger resections in breast conserving surgery. It is ideal in most mediums to large breasted woman providing the cancer is suitable for breast conserving surgery. This technique extends the role of breast conserving surgery by improving cosmetic outcomes, not by fundamentally changing the indications. Patients with extensive DCIS or multi-focal disease will need treating with a mastectomy. It may play a role for tumours reduced in size following neo-adjuvant treatment.[7] The techniques do also have a role in selected smaller to medium breasted woman, especially when ptosis is present. Even when being smaller is not deemed ideal, it may be preferred by a patient over mastectomy and total reconstruction. Oncological indications are the same as for standard breast conserving surgery including tumours up to 4 cm. There is little evidence on which to assess the safety of breast-conserving surgery for tumours over 4 cm.[15]

Another, more contentious group, include very large breasted woman with relatively small tumours who would benefit from a reduction mammaplasty for quality of life issues as well as having the cancer treated. This latter group are likely to have a good cosmetic outcome from simple wide local excision but view reduction mammaplasty as a positive outcome of any cancer surgery. However, this group may have greater morbidity from post-operative radiotherapy, which can be troublesome in large-breasted women.[16,17] The homogeneity of the radiation dose, with skipping of areas, may be less consistent in large breasts.[18]

The alternative for many patients to therapeutic mammaplasty is mastectomy and total reconstruction, either primary or delayed. In some instances where radiotherapy after mastectomy is likely, immediate reconstruction is increasingly not advised. This is especially true for any implant based reconstruction. Autologous reconstruction usually copes far better but can still be affected[19] (as may a breast treated by therapeutic mammoplasty). When only one autologous option is available it is always a risk to knowingly give radiotherapy. As therapeutic mammoplasty represents BCS the patient will always be given radiotherapy for invasive tumours regardless of grade, vascular invasion and lymph node status. For such women, therapeutic mammaplasty may be an

ideal option for a cosmetically acceptable result from primary breast surgery plus radiotherapy.

The cosmetic outcome from therapeutic mammaplasty is often similar to reduction mammaplasty. Although autologous reconstruction can also give excellent cosmetic outcomes it will not ordinarily maintain the same degree of skin or nipple sensation. Recovery from therapeutic mammaplasty is very similar to standard reduction mammaplasty and is likely to be quicker than the other options stated. Although undoubtably more complicated than simple wide local excision (so adding operative time) this technique will avoid total reconstruction in many cases, which may overall make it time efficient.

The excision of the tumour is usually very wide as it is taken with a mammaplasty excision. As the margin of excision increases, so the chances of incomplete tumour excision reduces. For this reason, wide excision may have some oncological advantage in terms of local recurrence particularly in smaller tumours where quadrentectomy has some potential benefit.[20] Due to patient numbers this has not been formally assessed as an advantage of therapeutic mammaplasty in the studies to date, even though excisions are frequently larger than a traditional quandrentectomy. Reduction mammaplasty in noncancer patients has been associated with a reduced risk of subsequent breast cancer.[21] Therapeutic mammaplasty may, therefore, be risk reducing in both the treated and contralateral breast. All of these potential oncological advantages are not proven and are important potential areas of study.

Potential disadvantages of therapeutic mammaplasty

This surgery is a lot more involved than simple wide local excision. It takes more time and impacts on theatre resources although this is not the case when the alternative for comparison is total breast reconstruction.

Surgery is to both breasts and obviously potential complications are to both sides. These include altered nipple sensation, variable scar quality, wound problems, fat necrosis, nipple loss and bleeding. Any major wound complications have the potential to delay adjuvant radiotherapy. Four out of 101 patients had a delay in radiotherapy and one out of 101 had chemotherapy delay in the series from Clough et al.[7] However, this potential problem reinforces the need for a safe technique to be employed.

As this is breast conserving surgery radiotherapy is required, which can affect the breast over time. This can range from acute changes to skin and parenchyma to simple volume asymmetry. This is usually from the nonirradiated breast increasing in volume to a greater degree than the irradiated breast. With the complexity of some therapeutic mammaplasty procedures it may be expected that wound or fat necrosis rates may be higher than standard wide local excision.

It was stated under the 'advantages' that patients who will definitely require radiotherapy may be a good group to consider using therapeutic mammaplasty. Similarly, patients who can avoid radiotherapy with mastectomy and total reconstruction should have this option considered even when therapeutic mammaplasty is available.

Patient selection and tumour assessment

Therapeutic mammaplasty involves bilateral surgery and will make both breasts smaller. The ideal patient has a tumour consistent with scenario A (tumour lies within expected area of reduction mammaplasty excision) who has enough breast tissue for a mammaplasty and deems a reduction mammaplasty as a positive outcome. Most patients in scenario B are suitable providing the breast is of sufficient size and has some ptosis. Some patients are suitable who do not consider mammaplasty a benefit, but in light of other options consider it the best way of optimising cosmesis.

Risk factors for complications are as with reduction mammaplasty. These include high BMI, smoking, very large breasts and diabetes. These must be taken into account when choosing suitable patients and the techniques available. These risk factors are shared for all surgery but may be less with therapeutic mammaplasty compared to mastectomy and total reconstruction.

Pre-operative assessment should utilise all methods available for predicting multifocality, such that suitability for breast-conserving surgery or extent of excision required can be judged. Useful in this regard are standard imaging techniques such as mammography and ultrasound. MRI may add useful information to guide the extent of surgery and identify some women for whom mastectomy is the procedure of choice.

In some instances where suitability for breast-conserving surgery is in real doubt, an initial wide local excision can be performed, with completion therapeutic mammaplasty (or mastectomy $\pm$

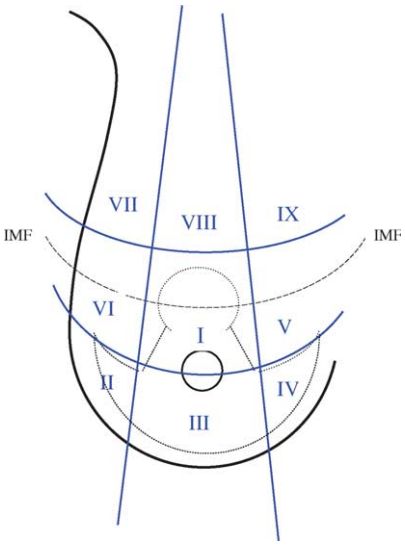

Figure 1 Zones of the breast orientated around the proposed mammaplasty markings.

reconstruction) performed a few days later when histopathology is available.

Planning and surgery

For the benefit of explanation we divide the breast into nine zones (Fig. 1). These zones are orientated by mammaplasty markings for that particular breast. The infra-mammary fold (IMF) is used to mark the new or proposed nipple position, which dictates the centre of zone I. This zone extends 1–2 cm into the mammaplasty pillars. The inferior zones II–IV lie inferior to the mammaplasty pillars and represent the area classically excised with a superior pedicle mammaplasty. Central tumours not requiring nipple removal and these inferior zones can usually be removed with standard techniques. The peripheral areas within mammaplasty pillars and upper areas of the breast (zones V–IX) usually require some adaptation of techniques.

The lateral zones VI and VII are common sites for breast tumours and can be dealt with by extending the nipple pedicle or creating a secondary pedicle. Tumours in zone VIII are usually treated by extending an inferior pedicle or secondary rotation pedicles from zones VII and IX. Zone IX tumours are some of the hardest to treat but also some of the least common. These zones are not meant to be rigid and are intended to illustrate the options for therapeutic mammaplasty relative to different cancer sites (Table 1).

Scenario A—tumour lies within a routine reduction mammaplasty excision

Classically this could be an inferior pole tumour that can be excised with a wise or vertical pattern reduction using a superior pedicle for the nipple (Figs. 2 and 9). The options can be extended for other tumours by employing different pedicles,

Table 1 Common options for planning therapeutic mammoplasty

	Scenario	Common pedicle	Alternative pedicle	Common skin pattern	Alternative skin pattern	Ease to fill defect by extending pedicle	Ease to fill defect by secondary pedicle
Zone I	A or B	Inferior	Medial Lateral	Wise Vertical		na	na
Zone II	A	Superior Sup/medial	Medial Lateral	Wise	Vertical	na	na
Zone III	A	Superior Sup/medial	Medial Lateral	Wise Vertical		na	na
Zone IV	A	Superior Sup/medial	Medial Lateral	Wise	Vertical	na	na
Zone V	B	Sup/lateral Lateral	Inferior Superior	Wise	Vertical	Fair	Fair
Zone VI	B	Sup/medial Medial	Inferior Superior	Wise	Vertical	Excellent	Good
Zone VII	B	Sup/medial Medial	Inferior Superior	Wise	Vertical	Good	Fair
Zone VIII	B	Inferior	Medial Lateral	Wise Vertical		Excellent	Fair
Zone IX	B	Sup/lateral Lateral	Inferior Superior	Wise	Vertical	Fair	Fair

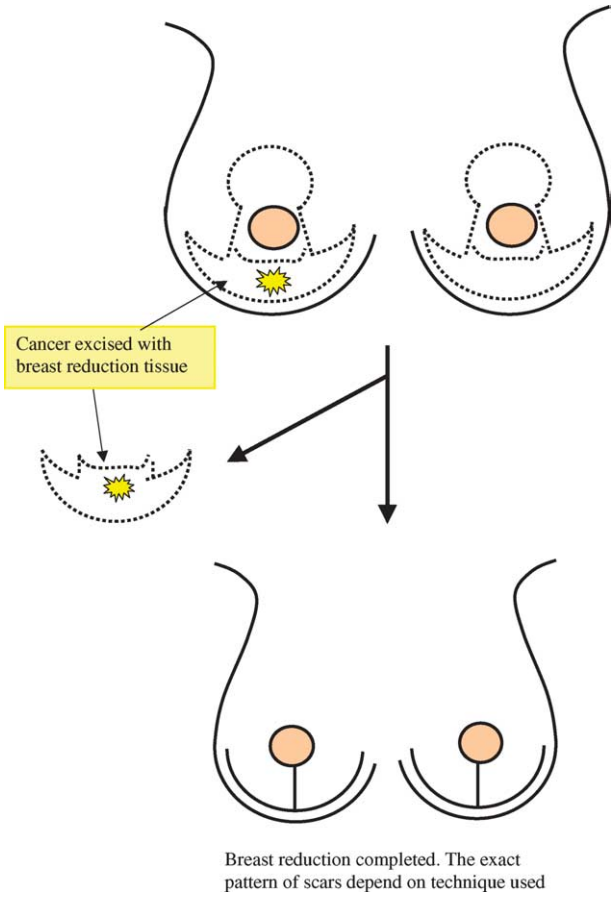

Figure 2 Scenario A. Cancer excised within the standard excision of a reduction mammaplasty. In this case an inferior tumour excised using a wises pattern with superior pedicle.

such as an inferior pedicle for tumours above the nipple and so on for medial/lateral tumours. However, whichever method is selected it does not need to be adapted. This mostly relates to tumours in zone I–IV.

The pedicle orientation will be dictated by the tumour position. Most inferior tumours (zone II–IV) are treated with superior or superio-medial pedicles. The central tumours (zone I) are a mixed group with pedicles from almost any direction or require removal of the nipple negating the need for a nipple pedicle (see central tumours). If the tumour is central but the nipple can be preserved then the pedicle options will be dictated by the defect.

The skin pattern chosen will be influenced by the breast morphology, the need to remove skin over a tumour and surgical access to the tumour site. Central and Inferior tumours (zones I and III) may be treated as easily by vertical as wise pattern methods. Outer or inner inferior tumours (zones II and IV) treated with a wise pattern afford greater ease of access.

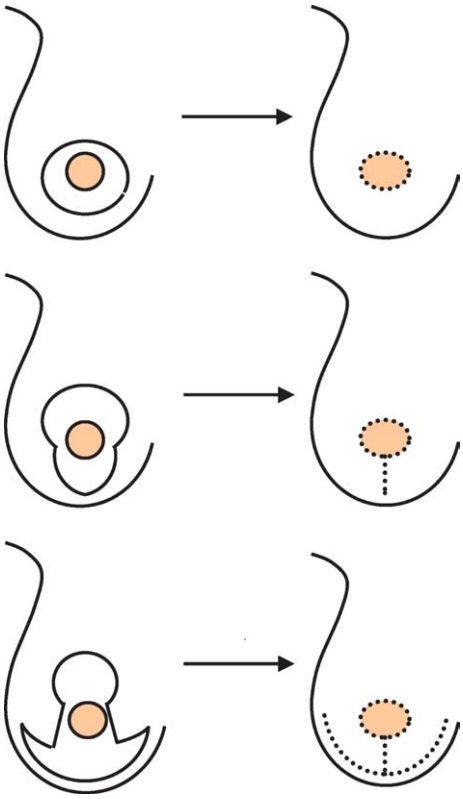

Figure 3 Different skin incisions options for planning in therapeutic mammaplasty.

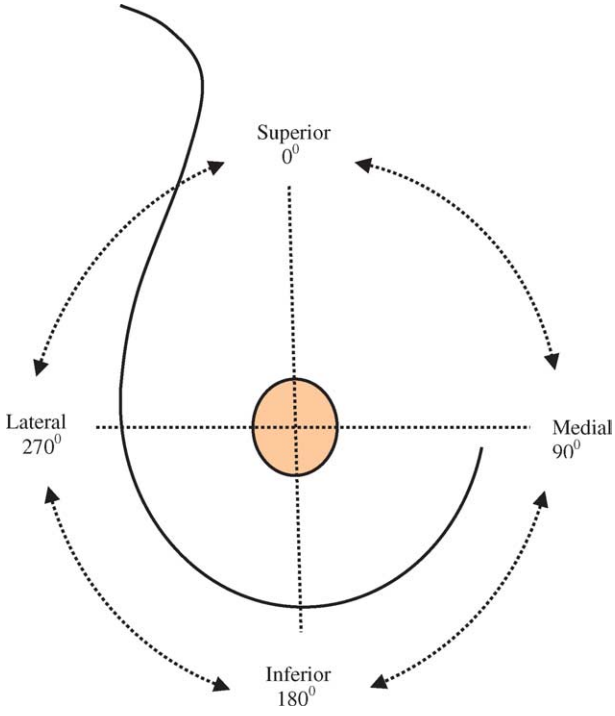

Figure 4 Options of nipple pedicle orientation from 360°.

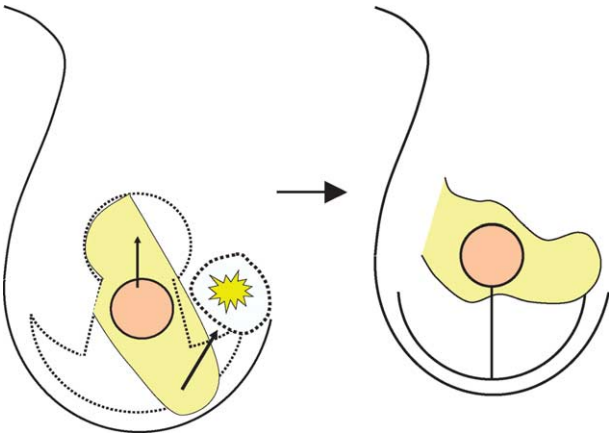

Figure 5 Scenario B. Filling the defect by extending the pedicle. The pedicle carries tissue normally excised into the defect.

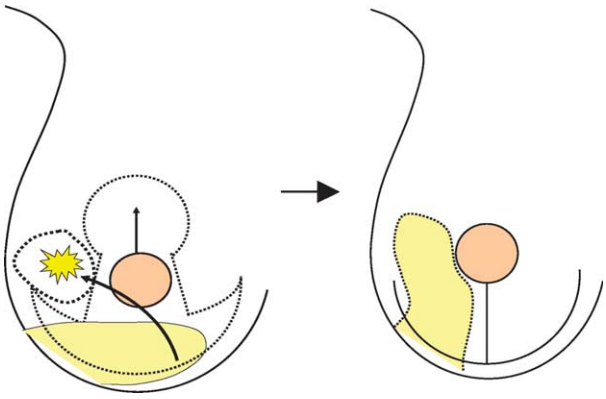

Figure 6 Scenario B. Filling defect by creating a secondary pedicle.

The markings and technique will be standard for the mammaplasty technique chosen. However, undermining the inferior pole of the breast off the pectoral fascia enables bi-manual palpation of inferior tumours to help ensure appropriate surgical margins. It is preferable and may be easier to simply excise the tumour within the larger mammoplasty excision. This does differ to scenario B where the tumour is removed with a margin and additional tissue removed once the reconstruction is planned and intraoperative radiology is viewed. However, if simpler it is feasible in scenario A to also initially excise the tumour. Liga-clips can be used to mark the excision site.

Axillary surgery can be performed through the tail of a Wise pattern or through a second axillary incision if a vertical technique is employed. The contralateral breast is treated by the same standard technique.

In our experience a vertical or wise pattern incision in combination with a superior, superio-medial or inferior pedicles will manage the majority of scenario A cases. The use of medial and lateral pedicles as commonly used with some methods would also work well depending upon a surgeons preference and experience.

Scenario B—the tumour lies outside of a standard mammoplasty method

This refers to very superior, medial or lateral tumours or those that occur in the area that would form either the medial or lateral pillar of the mammoplasty (zones V–IX). In these cases a modification to the mammoplasty technique must be planned.

Three decisions are needed for planning;

1. The skin pattern incision (Fig. 3).
2. The NAC pedicle orientation to carry the nipple (Fig. 4).
3. Method of filling the cancer defect. The latter can be achieved by either extending the nipple pedicle (Fig. 5) or by creating a secondary pedicle carrying tissue that is normally excised into the cancer defect (Fig. 6).

Planning is important and step-like. The skin pattern chosen will be mostly influenced by the amount of breast skin and tumour position. The wise and vertical patterns have predominantly been used. Peri-aereolar and L-shaped designs have also been employed. The wise is very versatile in allowing good access for tumour excision and removing excess predictably in cases of marked ptosis.

The presence of previous scars will influence the skin incisions. The most common problem is a transverse scar across one of the skin pillars. A vertical technique can be safely employed in this scenario. Another option with vertical techniques is to rotate the markings (Fig. 8). This change can be used to orientate over the tumour or to include previous scars. When a wise pattern is still preferred it can be manipulated by changing the position of either the vertical or horizontal limbs to incorporate the scars. Skin can be left on the IMF on the side of the scar so creating a stepped incision or simply both sides are raised to the level of the scar leaving a transverse incision higher on the breast mound. All other components of the mammaplasty are the same.

Both breasts can be operated on at the same time. The tumour is excised with a margin (chosen according to type of disease and volume of breast). This is accessed via the planned skin incisions. This usually entails lifting the overlying skin off and the

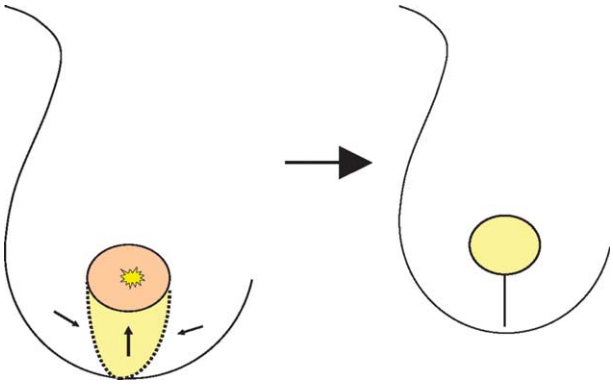

Figure 7 Excision of central tumour. Reconstruction with inferior parenchymal/skin pedicle. Nipple reconstruction can be done on the skin paddle.

tumour and the resection performed down to the pectoral fascia. This is then orientated and sent for specimen X-ray. The axillary surgery is also performed. With experience it is feasible to gauge the required reduction on the contralateral side, which is completed while the tumour is excised. Once the reconstructive plan and radiology has been reassessed further tissue can be removed as required and the reshaping be completed on the tumour side.

It is well recognised that the nipple can be moved from many different directions. Although preferable to use established pedicles we would suggest there is a 360° possibility to safely move the nipple. Most pedicle orientations can be adapted to fit with most types of skin incisions be it a wise or vertical

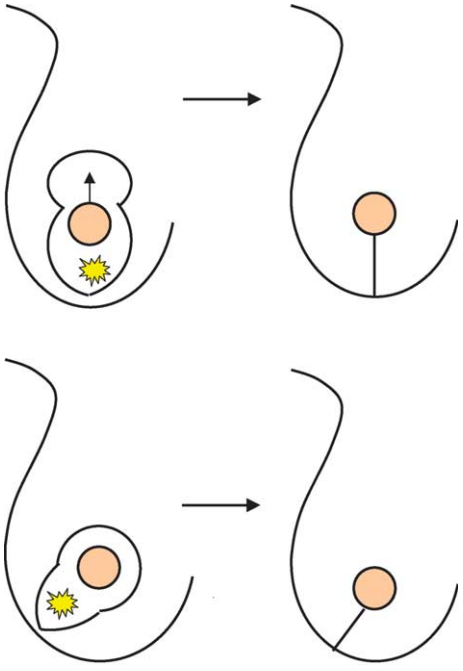

Figure 8 Modification of traditional procedures to excise a tumour.

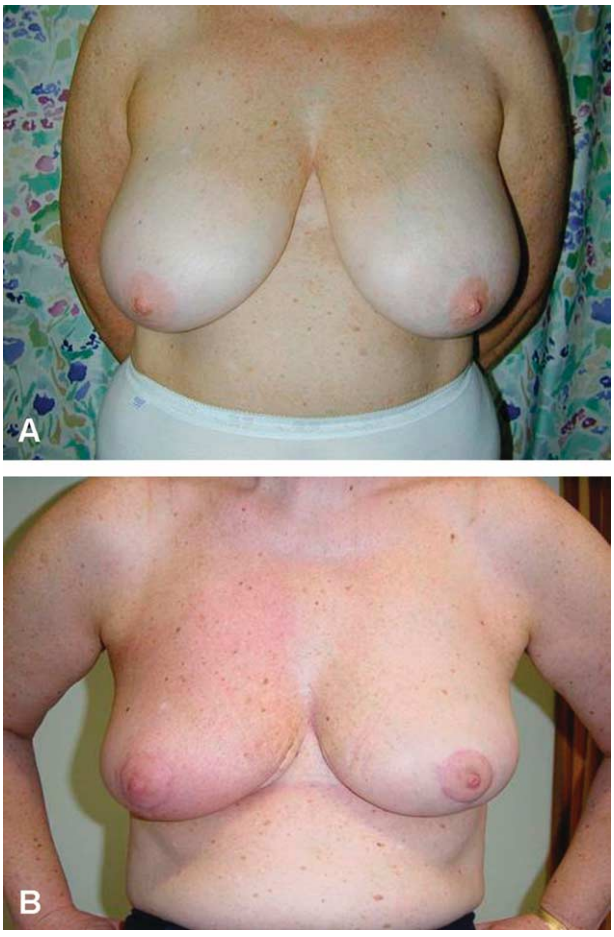

Figure 9 Scenario A. Inferior pole tumour. Pre- and post-surgery and radiotherapy.

pattern so making the choice of skin incision independent of the NAC orientation. With such variations the options to fill the tumour defect by extending the pedicle or creating a secondary pedicle become very large although the principles very simple. However, despite so many options many cases will be managed with a more traditional set of pedicles. It is the intention to move sufficient reliable tissue from the area that is ordinarily excised. Therefore, extending a superior or superior-medial pedicle into the inferior central zone (zone III) or an inferior pedicle above the nipple into zone I or VIII is commonly performed. They are reliable and rotate well into the lateral and medial pillars. It is when this appears too long or kinks that a secondary pedicle is usually used. It is preferable to have a surgical plan prior to surgery. The skin incision pattern and nipple pedicle orientation can always be decided. However, it is feasible to leave decisions to either extend the pedicle or create a secondary pedicle until during the procedure, once the wide excision of the cancer

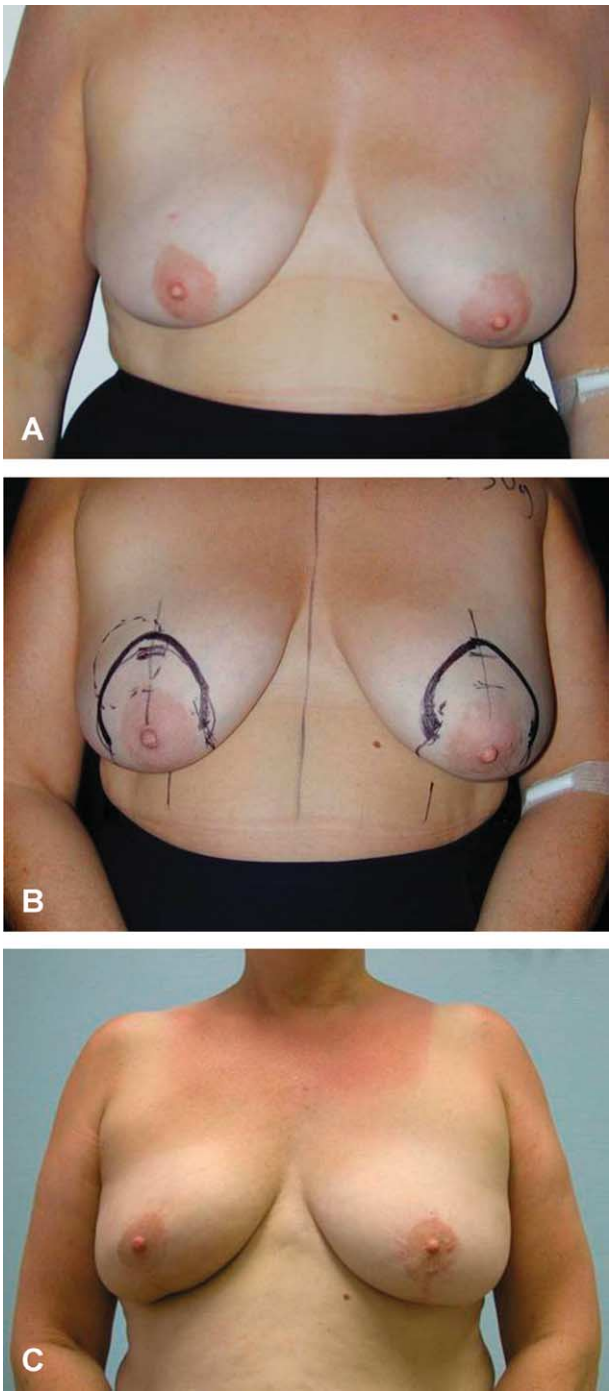

Figure 10 Scenario B. Extending the pedicle to fill the defect. Pre- and post-operatively.

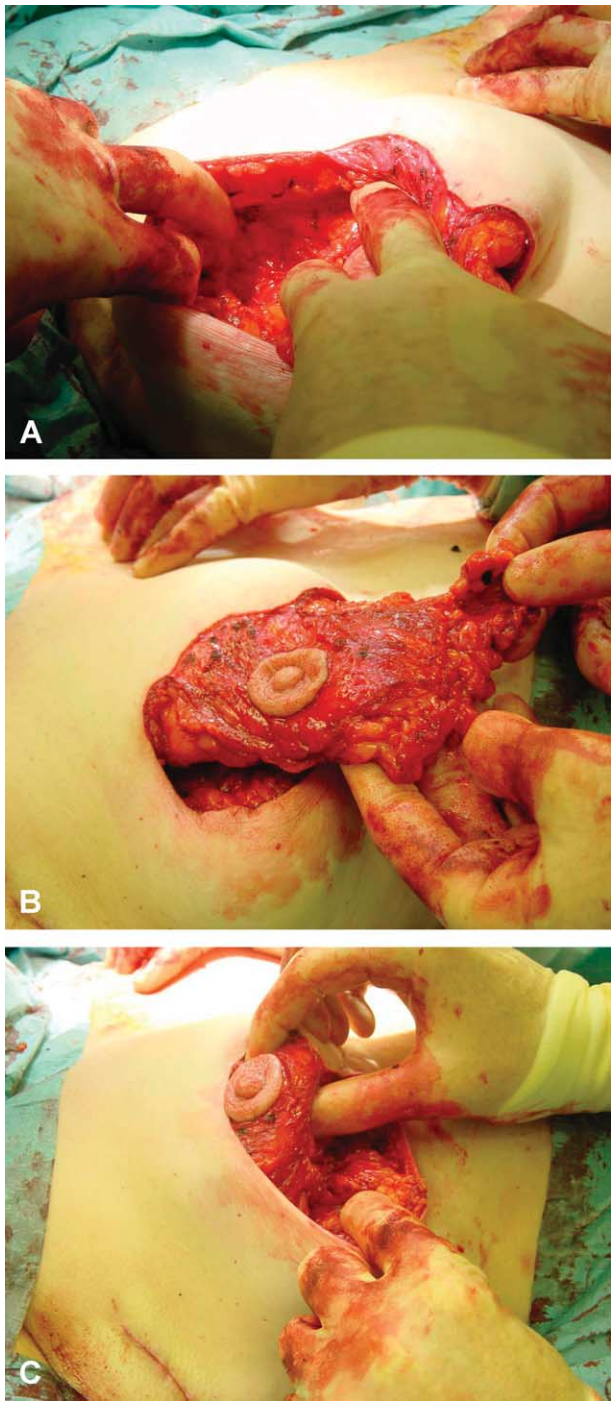

Figure 11 Scenario B. Intraoperative views. Extending the pedicle to fill the cancer defect. (A) The cavity in the upper outer breast following excision. (B) The superior-medial pedicle is extended into the normally excised inferior tissue. (C) The extended pedicle is folded to carry the nipple and fill the defect.

has been performed and the resulting defect assessed.

Skin excision over the tumour is not routinely practiced in Nottingham but is standard in some units. If skin needs to be removed, due to oncological indications or preference, then the planning principles do not change. However, instead of carrying only parenchyma on an extended pedicle or on a secondary pedicle, skin is also carried to fill both the parenchymal and skin defects (see case 6).

Vascularity of the pedicles should be ensured as

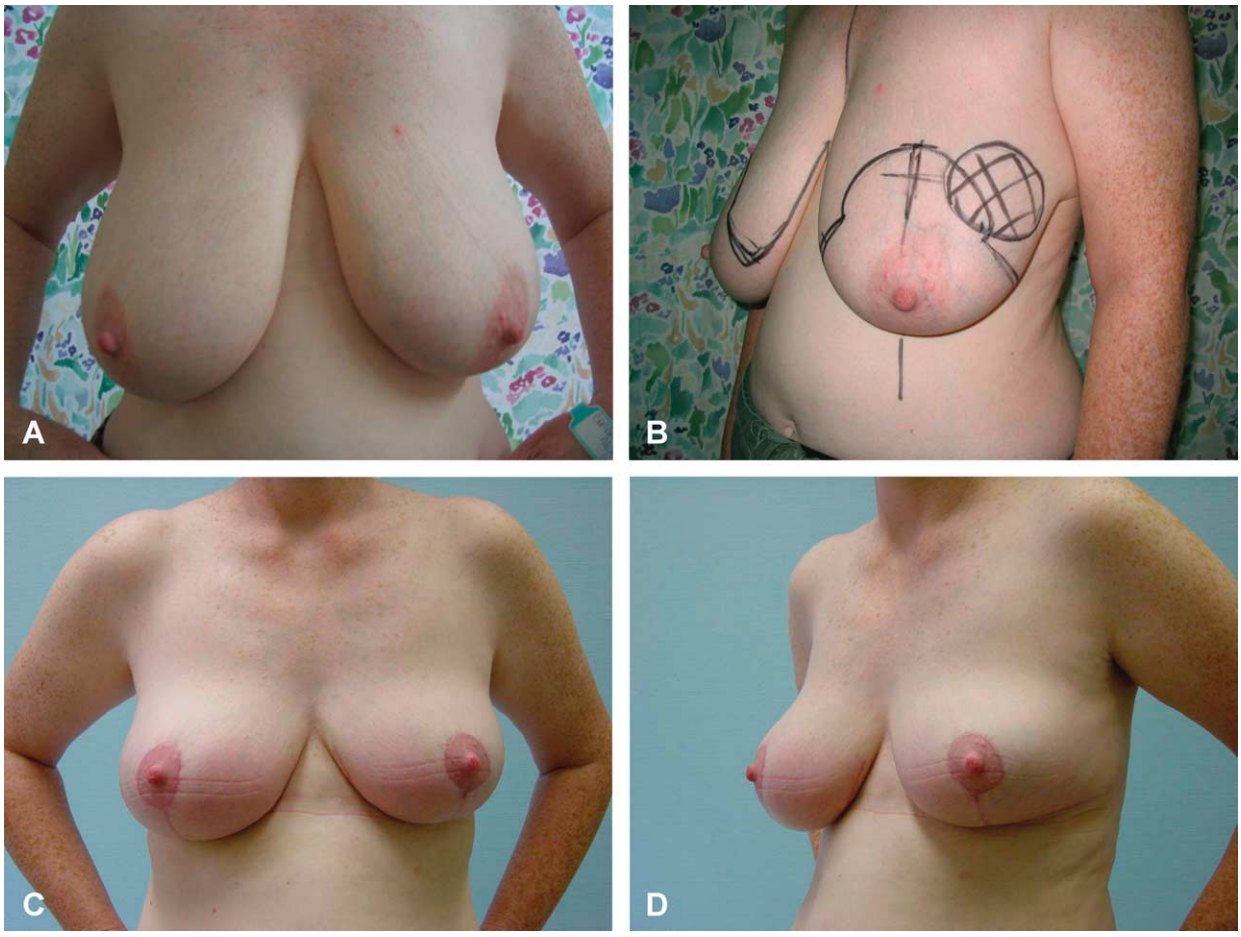

Figure 12 Scenario B. Tumour excision filled by secondary pedicle. Pre- and post-operative views.

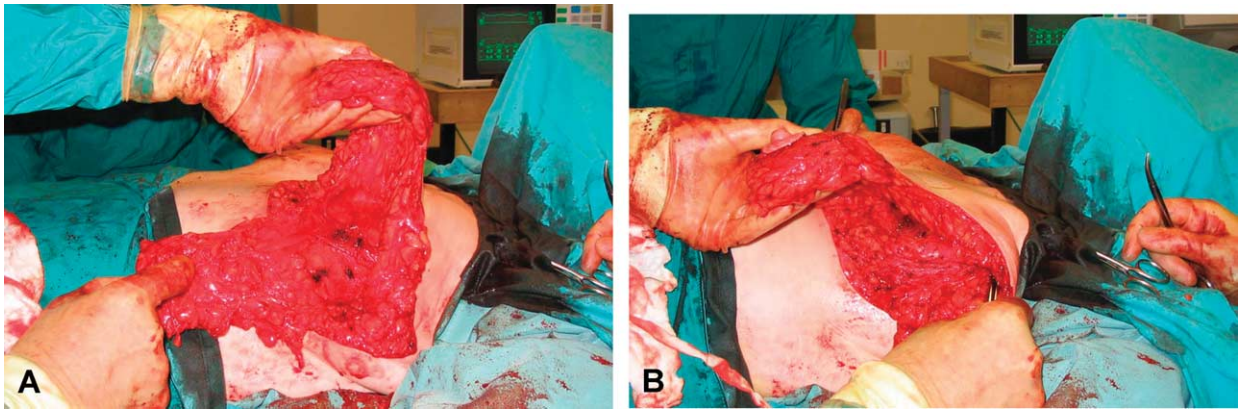

Figure 13 Use of secondary pedicle to fill the tumour defect. Intraoperative views. The NAC pedicle is held above the breast and the secondary pedicle below. This is transposed into the upper lateral defect.

much as possible to avoid fat necrosis. The pedicle should be dissected only to the amount to allow the required movement. A slightly shorter safer pedicle may be accepted if needed. The pedicle used to fill the defect is sutured into position and the mammaplasty closed as standard. If there is abundant predictable filler pedicle then more tissue from the tumour bed may be removed, rather than shortening the pedicle.

Deciding between extended NAC pedicle and a secondary pedicle is a question of vascularity and ease of rotation. Whichever will be more reliable

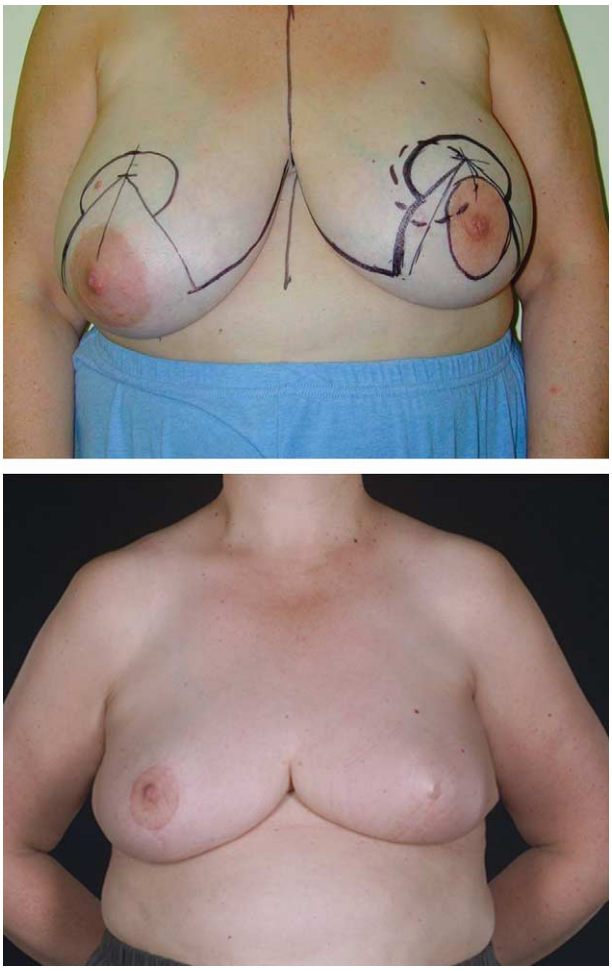

Figure 14 Excision of central tumour and reconstruction with inferior pedicle and immediate nipple reconstruction. Pre-operative view which outlines the tumour in a dotted line and the 2-year post-operative view.

and easy to manipulate should be chosen. In our experience extension of the pedicle is more commonly performed.

We recommend in scenario B to use a standard method and pedicle on the contralateral side. This does not appear to alter the symmetry of shape.

Tumour margins

Nearly all cases can be performed as a single stage procedure. Due to the width of the macroscopic excision margins, microscopic histological margins are rarely positive. When they are it is usually for very extensive disease that quite clearly dictates mastectomy as the correct surgical procedure. When a mastectomy is required, the contralateral reduction still has the potential benefit of making subsequent reconstruction or prosthesis fitment easier. There are a few cases when the technique is used on smaller breasts where margins may not be so wide or the contralateral surgery not deemed an advantage in isolation. In such cases it is worth considering a two stage procedure to obtain histology and perform the mammaplasty 10–14 days later, or perform unilateral mammaplasty.

Central tumours (zone I) requiring removal of the nipple

This group of tumours can be treated by different mammaplasty techniques. The first and simpler option is an inverted T closing wedge mammaplasty. The whole central area is removed including the nipple. An inverted T skin and parenchymal excision is performed. There are no pedicles to either carry the nipple or fill the defect. This is a very simple and reliable method without any parenchymal or NAC pedicles. It can also be employed for all zone I–IV tumours when a reliable technique is required in patients with very large breasts, risk factors or in any patients who is not adverse to losing the nipple (Fig. 15).

An alternative method is to use an inferior pedicle to carry parenchyma and skin into the central defect to both fill the parenchymal and skin defect. This is similar in principle to technique described by Grissotti.[22] It is our practice to perform an immediate nipple reconstruction on the advanced skin paddle (Figs. 7 and 14). This can be a true inferior pedicle for most Wise pattern cases. When a vertical pattern is used the inferior pole is usually excised and we find the use of a medial, lateral or horizontal bi-pedicle better. A standard vertical technique with a superior pedicle is usually used on the contralateral side (Fig. 8).

Case discussions

Scenario A

Case 1—standard wise pattern with superior medial NAC pedicle

A 56-year-old lady with a 35 mm tumour in inferior pole (zone III). Grade II on core biopsy. Generally fit and well, nonsmoker. Wears D cup bra, but would prefer to be B–C cup. A standard wise pattern incision with a superior-medial pedicle for the nipple is chosen. No alteration to the mammaplasty technique required with a 532 g excision. Sentinel node biopsy and node sample done through the lateral extent of the incisions. Seen 2 months after completion of post-operative radiotherapy (Fig. 9).

Scenario B

Case 2—extension of the nipple pedicle to fill the defect

A 47-year-old lady with a 3.0 cm tumour in the upper lateral zone (zone VII). Grade III on core. Generally fit and well, wears a C cup bra and does not want a large reduction. A vertical skin pattern is chosen as a large skin reduction is not required (Fig. 10). A superio-medial pedicle is chosen with an extension into inferior central zone. The pedicle is rotated to both fill the defect and carry the nipple (Fig. 11). An inferior pedicle with a superior excision would be an alternative in this case. Total excision weight 95 g.

Case 3—secondary pedicle created to fill defect

Forty-three-year-old lady with a 4.5 cm phylloides tumour in upper outer quadrant (zone VI). Generally fit and well. She has long ptotic breasts needing a large skin reduction. Therefore, a wise pattern is chosen for the skin incisions (Fig. 12). Superio-medial pedicle is chosen for the nipple. Due to the long length of pedicle already carrying the nipple a secondary lateral pedicle used to fill the defect (Fig. 13). This is felt to be more reliable. Total excision weight was 446 g from the left breast.

Case 4—central tumour excised with immediate nipple reconstruction

A 49-year-old lady with a 35 mm cancer in central area adjacent to the nipple (zone I). Grade II on core biopsy. She is generally fit and well. The central area and the nipple need to be removed. She is keen to be moderately smaller and to have a nipple reconstructed. Due to size of the breast a wise pattern chosen for the skin. An inferior pedicle of both parenchyma and skin is advanced to fill defect and immediate nipple reconstruction performed on skin paddle (Fig. 14). Total excision weight 782 g.

Case 5—wise pattern wedge closure with removal of nipple

Forty-seven-year-old lady with a 25 mm inferior-medial tumour (zone IV) of the left breast after incomplete excision. Patient has hypertension. She is keen on being smaller but not worried about nipple preservation on the cancer side. Standard reduction on contralateral side and inverted T wedge closure on left side performed (Fig. 15). Total excision weight 570 g This is a safe reliable procedure with no pedicles involved.

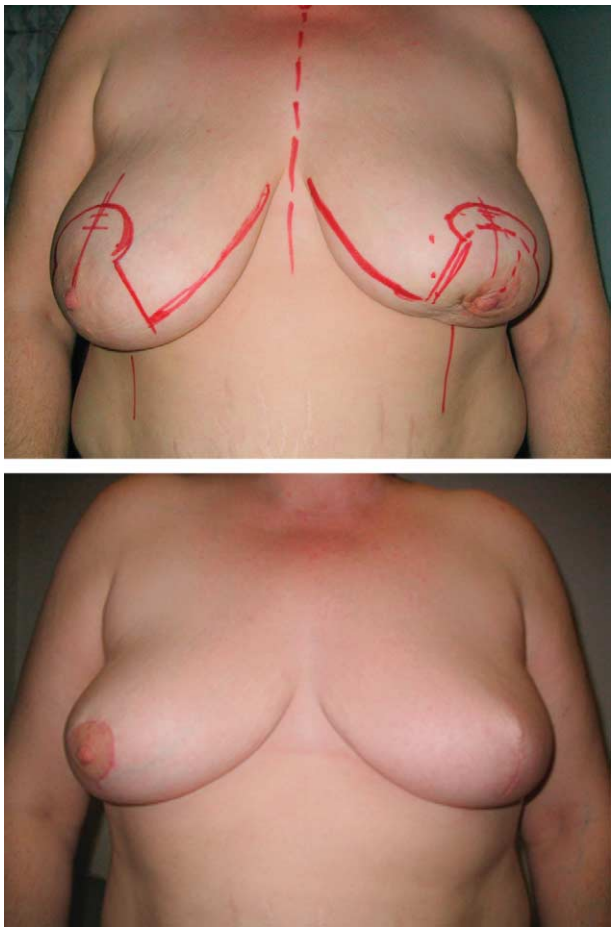

Figure 15 Scenario A. Inverted T closing wedge mammaplasty. Pre-operative and post-operative views.

Case 6—reconstructing overlying skin defects excised with the tumour with extended or secondary pedicles

Forty-five-year lady with a lateral tumour (zone VI) showing some skin tethering. She has moderate sized pendulous breasts. A wise pattern skin incision is planned. The tumour is excised with overlying skin. The nipple is carried on a superior-medial pedicle, which is extended to fill the parenchymal defect and reconstruct the excised area of skin (Fig. 16).

Discussion

This paper describes an approach to therapeutic mammaplasty. It is based on the first 50 clinical cases we have performed. It is not meant to be prescriptive but represents an approach we have found logical and helpful. Table 1 is a guide to options for each of the tumour zones. Therapeutic

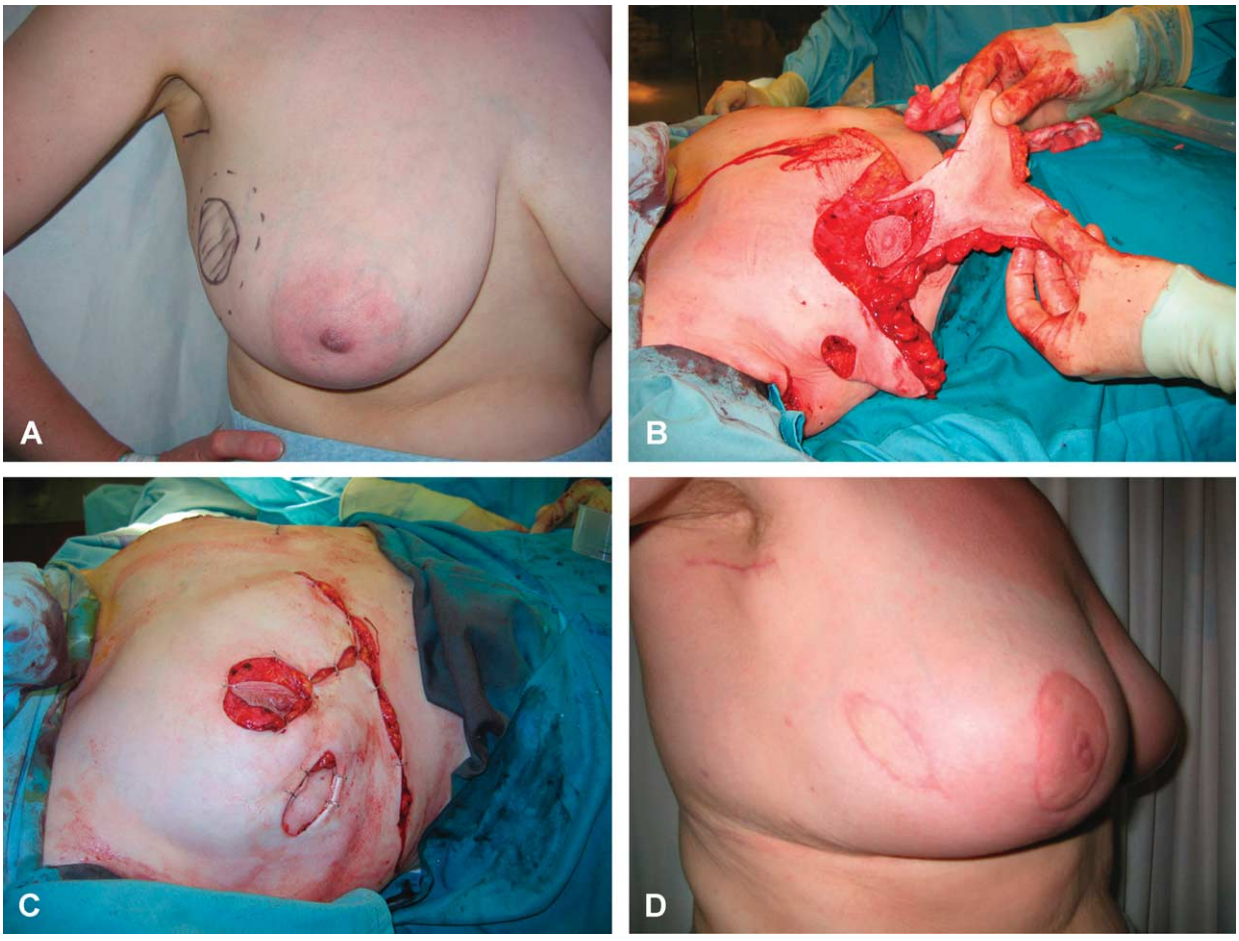

Figure 16 Reconstructing overlying skin defects excised with tumours. (A) Pre-operative view shows lateral tumour with skin attachment. (B) Intraoperative view showing the skin defect created by excision of the tumour in the lateral aspect of the breast. The superior-medial pedicle carries the nipple and is extended. Part of this extension will be used to fill both the parenchymal and skin defect. (C) The extended pedicle is temporarily closed to plan exact position of skin island. (D) Post-operative view.

mammoplasty offers an option that can both widely excise the tumour and give an acceptable or even improved cosmetic outcome. This method does not replace mastectomy and indeed does not change any of the underlying selection issues regarding BCS except the ability to improve cosmetic outcome. We believe this method to have an expanding role in the repertoire of surgical options for breast cancer.

However, like all surgical procedures that form part of the treatment for breast cancer, it must be performed safely with minimal complications. Adjuvant radiotherapy is still required despite the very wide excision in some cases. Similarly every effort should be made to avoid fat necrosis, which may be confused with recurrence and cause distress to the patient if it occurs. It is vital that a surgeon understands and be comfortable with the different techniques in mammaplasty surgery if they wish to perform this technique. We recommend that scenario A patients are the most suitable cases to be selected when starting to use therapeutic mammaplasty. Partnerships between breast and plastic surgeons should be encouraged, and indeed two surgeon teams are very time efficient. Once a working and successful team is established the more complex cases as in scenario B should be attempted. This larger group of patients then allows this technique to be increasingly used.

The potential advantages of therapeutic mammaplasty are cosmetic, psychological and may be oncological. With increasing patient numbers and experience the long term value of these differing techniques can be fully evaluated.

References

1. Fisher B, Anderson S, Redmond C, Wolmark N, Wickerham D,

Cronin W. Reanalysis and results after 12 years of follow-up in a randomised clinical trial comparing total mastectomy with lumpectomy with or without irradiation in the treatment of breast cancer. *N Engl J Med* 1995;**333**:1456–61.
2. Cochrane R, Valasiadou P, Wilson A, Al-Ghazal SK, Macmillan RD. Cosmesis and satisfaction after breast conserving surgery correlates with the percentage of breast volume excised. *Br J Surg* 2003;**90**(12):1505–9.
3. Al-Ghazal SK, Fallowfield L, Blamey RW. Does cosmetic outcome from treatment of primary breast cancer influence psychological morbidity? *Eur J Surg Oncol* 1999;(25):571–3.
4. Noguchi M, Taniya T, Miyazaki I, Saito Y. Immediate transposition of a latissimus dorsi muscle for correcting a postquadrantectomy breast deformity in Japanese patients. *Int Surg* 1990;**75**:166–70.
5. Raja M, Straker V, Rainsbury R. Extending the role of breast conserving surgery by immediate volume replacement. *Br J Surg* 1997;**84**:101–5.
6. Clough K, Nos C, Salmon R, Soussaline M, Durand J. Conservative treatment of breast cancers by mammaplasty and irradiation: a new approach to lower quadrant tumors. *Plast Reconstr Surg* 1995;**96**(2):363–70.
7. Clough K, Lewis J, Couturand B, Fitoussi A, Nos C, Falcou M. Oncoplastic techniques allow extensive resections for breast-conserving therapy of breast carcinomas. *Ann Surg* 2003;**237**(1):26–34.
8. Spear S, Pelletiere C, Wolf A, Tsangaris T, Pennanen M. Experience with reduction mammoplasty combined with breast conservation therapy in the treatment of breast cancer. *Plast Reconstr Surg* 2003;**111**(3):1102–9.
9. Lanfrey E, Rietjens M, Garusi C, Petit J-Y. Mammoplasty for symmetry of the contralateral breast and its oncologic value. *Ann Chir Plast Esthet* 1997;**42**(2):160–7.
10. Garusi C, Petit J-Y, Rietjens M, Lanfrey E. Role of plastic surgery in the conservative treatment of breast cancer. *Ann Chir Plast Esthet* 1997;**42**(2):168–76.
11. Petit J-Y, Rietjens M, Garusi C, Greuze M, Perry C. Integration of plastic surgery in the course of breast-conserving surgery for cancer to improve cosmetic results and radicality of tumour excision. *Recent Results Cancer Res* 1998;**152**:202–11.
12. Nos C, Fitoussi A, Bourgeois D, Fourquet A, Salmon R, Clough K. Conservative treatment of lower pole breast cancers by bilateral mammoplasty and radiotherapy. *Eur J Surg Oncol* 1998;**24**(6):508–14.
13. Losken A, Elwood E, Styblo T, Bostwick J. The role of reduction mammoplasty in reconstructing partial mastectomy defects. *Plast Reconstr Surg* 2002;**109**(3):968–75.
14. Clough K, Kroll S, Audretsch W. An approach to the repair of partial mastectomy defects. *Plast Reconstr Surg* 1999; **104**(2):409–20.
15. Asgeirsson K, McCulley S, Pinder S, Macmillan R. Size of invasive breast cancer and risk of local recurrence after breast-conservation therapy. *Eur J Cancer* 2003;**39**:2462–9.
16. Gray J, McCormick B, Cox L, Yahalom J. External irradiation in large-breasted or heavy woman: analysis of cosmetic outcome. *Int J Radiat Oncol Biol Phys* 1991;**21**:347–54.
17. Gunilla C, Lawrence M, Curtis S, Leonard R. Acute and late morbidity of using a breast positioning ring in woman with large/pendulous breasts. *Radiother Oncol* 1999;**50**:277–81.
18. Moody AM, Mayles WP, Bliss JM, A'Hern R, Owen J, Regan J, et al. The influence of breast size on late radiation effects and association with radiation dose inhomogeneity. *Radiother Oncol* 1994;**33**:106–12.
19. Tran N, Chang D, Gupta A, Kroll S, Robb G. Comparison of immediate and delayed free TRAM flap breast reconstruction in patients receiving posymastectomy radiation therapy. *Plast Reconstr Surg* 2001;**108**(1):78–82.
20. Veronesi U, Volterrani F, Luini A, Saccozzi R, Del Vecchio M, Zucali R, et al. Quadrantectomy versus lumpectomy for small size breast cancer. *Eur J Cancer* 1990;**26**:671–3.
21. 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**(4):755–62.
22. Grisotti A. Immediate reconstruction after partial mastectomy. Operative techniques. *Plast Reconstr Surg* 1994;**1**: 1–12.