New oncoplastic techniques can avoid mastectomy

New oncoplastic techniques are revolutionising the surgical management of breast cancer in much the same way that breast conserving surgery did in the 1970s. These technically demanding procedures are used as alternatives to mastectomy in an increasing number of women. Emerging data on outcomes are confirming the clinical utility of this approach.

Breast-conserving reconstruction offers an important new alternative for patients who would otherwise require a mastectomy. This approach preserves as much normal breast tissue as possible, by combining the best oncological principles of tumour resection with the best reconstructive breast surgery principles to remodel the defect resulting from tumour resection. This means that the surgeon can optimise the local excision to achieve very wide tumour-free margins and, at the same time, minimise the cosmetic deformity that often accompanies very wide local excision of breast cancer.

The importance of optimal local excision has been confirmed by a recent meta-analysis (EBCTCG meta-analysis, *Lancet* 2005, p 2087), which showed for the first time that reducing the rate of local recurrence improves the survival of patients who have undergone surgery. This is key evidence that complete local excision, which we know reduces recurrence, can impact on survival. The conclusion of this study, which included more than 6,000 postmenopausal

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e-grandround

The European School of Oncology now presents weekly e-grandrounds which offer participants the opportunity to discuss a range of cutting-edge issues, from controversial areas and the latest scientific developments to challenging clinical cases, with leading European experts in the field. One of these will be selected for publication in each issue of *Cancer World*.

In this issue, Dick Rainsbury, director of the Oncoplastic Breast Unit, Royal Hampshire County Hospital, Winchester, UK, looks at the new oncoplastic procedures that are increasingly used as alternatives to mastectomy. His presentation is based on a review published in *Nature Clinical Practice Oncology* (vol 4, pp 657–664). The presentation is summarised by Susan Mayor.

The recorded version of this and other e-grandrounds, together with 15 minutes of discussion, is available at www.e-eso.net/home.do

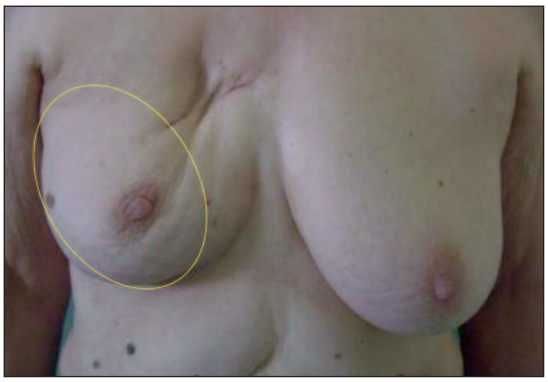
women from more than 70 randomised controlled trials, was that one breast cancer death could be avoided for every four local recurrences avoided over a 15-year period. Thus, it has been demonstrated that the quality of local surgery during breast-conserving procedures not only affects local recurrence but can also improve patient survival.

Unfortunately, there is a clash of interests in achieving optimal local excision. Werner Audretsch from Düsseldorf was the first to point this out, in his so-called 'oncoplastic scissors' (see figure below). If you increase the margins of excision you reduce the chances of there being residual disease after local excision; however, the further you move down the blades of the scissors from the hinges, the greater the chances of there being a poor cosmetic outcome. As you move towards the tips of these scissors, the greater the need for oncoplastic techniques to prevent a poor cosmetic outcome.

Balancing risk of residual disease against cosmetic result

This 'clash of interests' can lead to catastrophic cosmetic results. The patient in the figure *top right* had major volume loss in the upper inner quadrant of her right breast, and this led to a very poor cosmetic outcome. At least two-thirds of the breast is entirely normal, with normal sensation, shape, movement, and blood supply. Most surgeons faced with this kind of resection would advise the patient to have a mastectomy, but in doing so they throw away the approximately two-thirds of normal breast tissue.

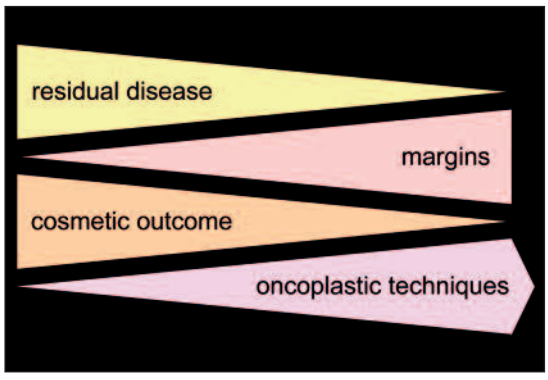
The patient in the figure below has had an extensive excision of the lower quadrant of her right breast, which has produced an unacceptable cosmetic result – a so-called 'bird's beak' deformity. Two-thirds of her breast remains normal, yet routine surgical practice would be to advise people like this to have a mastectomy.



At the moment we tend to think that there are only two options: breast conserving surgery or mastectomy. But these procedures offer a new third option, which combines the advantages of breast conservation and mastectomy, in that they achieve a very wide local excision. Early data suggest that the rates of local recurrence and local control are equivalent to mastectomy.

Breast-conserving reconstruction can resolve the 'clash of interests'. The techniques are hybrid procedures, which require the simultaneous deployment of the skills of an oncological and reconstructive surgeon in one procedure. The conventional techniques of breast resection and breast reconstruction are adapted to design and repair the defects – often very major – which are caused by this type of surgery, but without the cosmetic penalties discussed previously.

The key principles of this approach include wide local excision with wider margins than are usually achieved with breast-conserving surgery, lumpectomy or wide local excision, by immediately reconstructing the resection defect in a number of different ways. This leads to conservation of the normal breast tissue, which would normally be discarded, which can itself be of great benefit to the patient in the future. The natural breast tissue will feel normal and move normally. It avoids total mastectomy and more major breast reconstructive surgery and implant-related problems. These techniques essentially use well-established methods of breast-reconstruction surgery that have been tried and tested in different clinical situations.



The clash of interests in achieving optimal local excision

Selection of patients and tumours

The leading indication for breast-conserving reconstruction relates to the volume that needs to be resected to

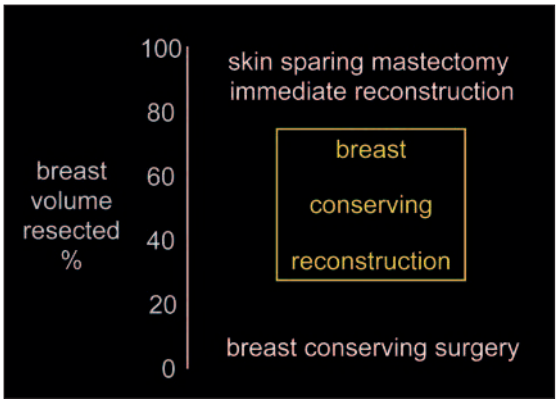
achieve a clear margin, because the fundamental principle of this type of surgery is that oncological principles must not be compromised. Referring back to the rationale set out earlier, this means breast-conserving reconstruction is indicated in patients who require 20%–50% volume loss to achieve a clear margin.

By definition, a partial mastectomy is indicated only for disease limited to a particular segment of the breast. However, the tumour can be in any location and it may be *in situ* or invasive. Breast-conserving reconstruction is particularly useful in patients who are very averse to having a mastectomy.

It is beginning to emerge that these procedures may also be useful in patients who would normally require radiotherapy after a full mastectomy, because there are quite a lot of data to suggest that the cosmetic outcome of irradiating fully reconstructed breasts is not good. As this applies to up to 25%–28% of patients, this is quite a large number. About 50% of them will have a poor or bad cosmetic outcome as a result of radiotherapy. Breast conserving reconstruction preserves most of the normal breast tissue, which generally appears to respond well to radiotherapy.

The leading cause of cosmetic failure in breast-conserving surgery is volume loss. Cochrane (2003), Bulstrode (2001) and others have shown that resection of more than 20% of the breast volume increases the chances of a bad cosmetic outcome. This is particularly true when resecting tumours in the medial half of the breast. Breast conserving reconstruction can help to overcome this problem and may be used to reconstruct defects when removing half, or even more than half, of the breast. In cases requiring removal of more than that, a full mastectomy with reconstruction can produce outstandingly good cosmetic results.

Most of the data that have been published on this show that the quadrants most at risk of cosmetic failure are in the upper, central and upper inner quadrant of the breast, which is obviously much more visible to the outside world, and also in the lower pole of the breast and in the centre part of the breast. Volume loss in the upper outer quadrant of the breast is not quite so much of a problem.



Volume loss is the leading cause of a poor cosmetic outcome
Source: Bulstrode et al. *Breast* 10:117; Cochrane et al. *BJS* 90:1505

What are the contraindications?

A definite contraindication is locally advanced or T4 tumours. Patients with multifocal disease require, by definition, a total mastectomy. Significant comorbidity is also an important issue, because these are not minor surgical procedures; they may require two to four hours of surgery. Patients with significant comorbidity may suffer a higher rate of complications after surgery. Comorbidity is an important point because breast cancer is more common as people get older. However, there are other benefits of breast-conserving reconstruction. Women with very heavy, ptotic breasts do not withstand radiotherapy very well. However, breast-conserving surgery which reduces the volume of the breast will make it easier to plan and deliver radiotherapy as part of adjuvant treatment, and may benefit the patient physically by giving her a lighter breast.

The balance between the physical and oncological benefit to the patient and the risk of the procedure is the key measure that the surgeon and the multidisciplinary team must weigh up before advising the patient and informing them of their choices.

There are also some special contraindications. If you are using a latissimus dorsi flap to reconstruct the defect, then an ipsilateral thoracotomy may have divided the muscle and made it unsuitable for reconstruction. Previous radiotherapy may affect the vascularity of flaps, increasing the risk of flap necrosis and infection after surgery.

BRCA-associated cancers

Patients with the BRCA genes are a special group, which seems to be increasing in size in clinical practice. Evidence is still being gathered, but these patients may not be best served by breast-conserving surgery because the whole breast is at risk, as well as the other breast. Many would consider counselling these patients about bilateral skin-conserving mastectomy rather than one-sided breast-conserving surgery.

Techniques currently used for breast-conserving reconstruction

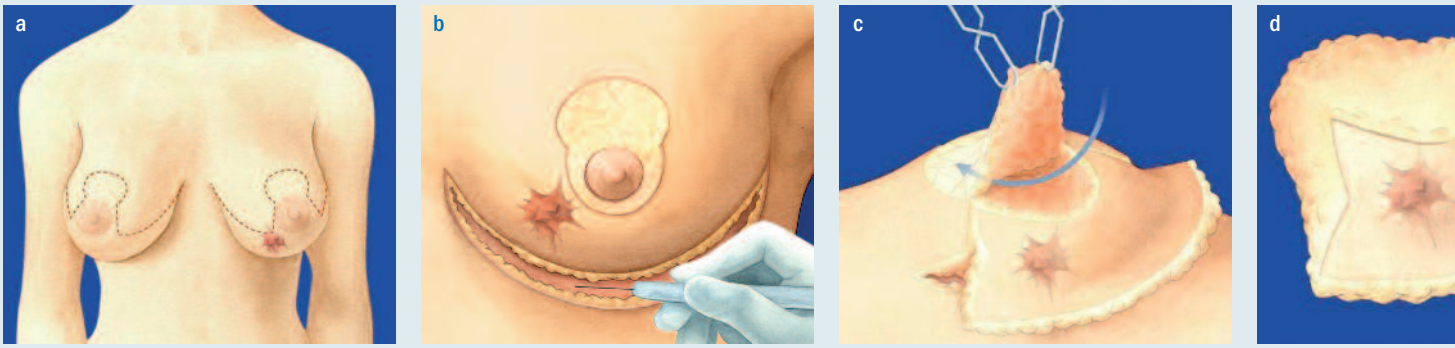
There are two fundamentally different types of approach to breast-conserving reconstruction: volume displacement techniques and volume replacement techniques.

In volume displacement techniques, the resection defect is reconstructed from 'pedicles' that are raised within the breast tissue itself. These 'pedicles' or parenchymal flaps, are moved into the gaps left behind after resection. As a result, there is a *(cont. page 18)* ▶▶

Volume displacement techniques

Superior pedicle for lower pole tumour

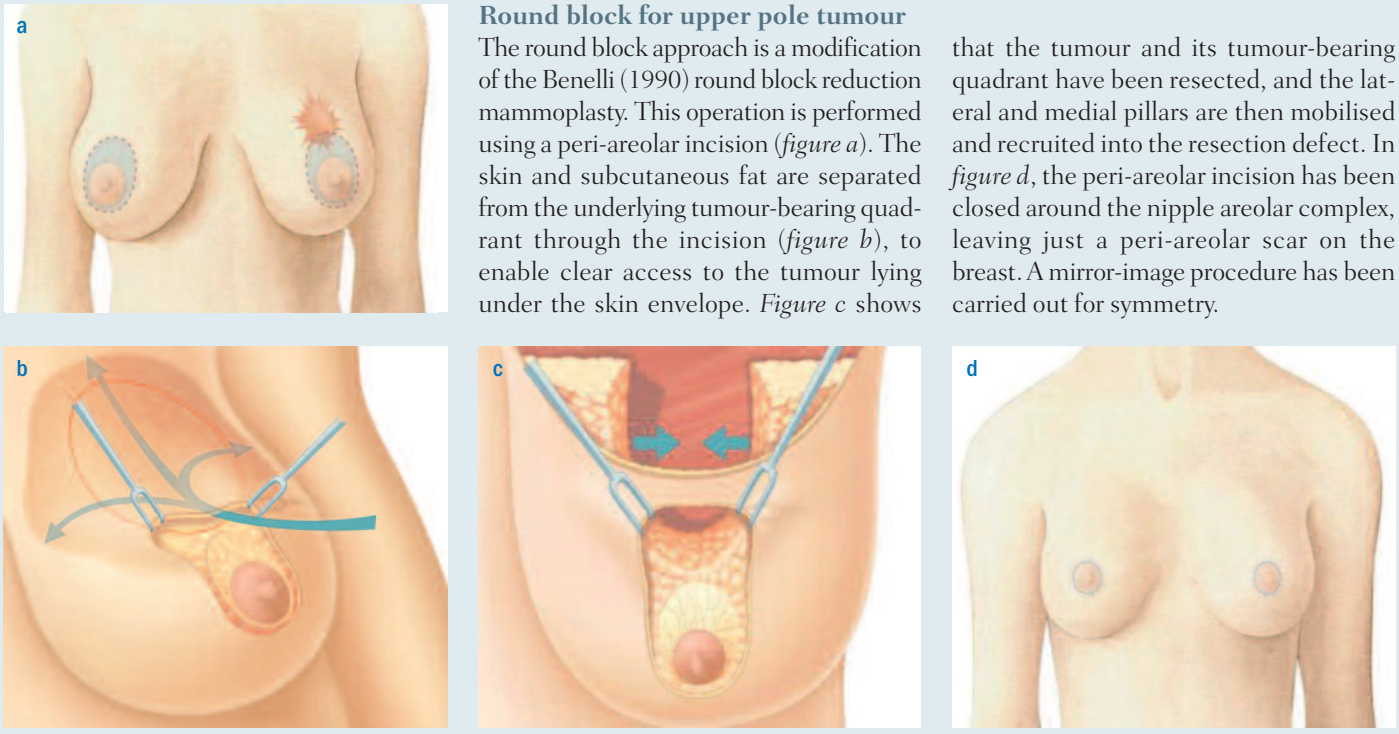
The strip of images below illustrates a superior pedicle technique for a lower pole tumour, and is taken from Benelli (*Aesth Plast Surg* 14:99). This technique was popularised by Krishna Clough in Paris (*PRS* 96:363). *Figure a* shows a patient with a lower pole tumour in her left breast, showing the preoperative mark-up. The next figure (*b*) shows the inferior mammary incision through which the lower pole of the breast containing the tumour (shown just above the incision) is mobilised. *Figure c* is a diagrammatic representation of the mobilisation of the nipple areolar complex of the superior pedicle.



Source of figures: Krishna Clough

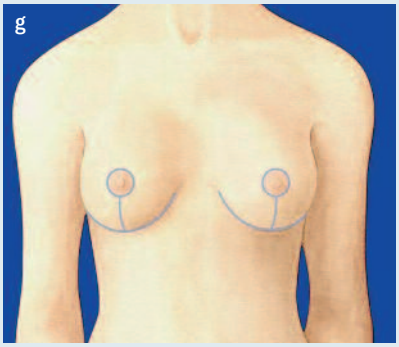
Round block for upper pole tumour

The round block approach is a modification of the Benelli (1990) round block reduction mammoplasty. This operation is performed using a peri-areolar incision (*figure a*). The skin and subcutaneous fat are separated from the underlying tumour-bearing quadrant through the incision (*figure b*), to enable clear access to the tumour lying under the skin envelope. *Figure c* shows that the tumour and its tumour-bearing quadrant have been resected, and the lateral and medial pillars are then mobilised and recruited into the resection defect. In *figure d*, the peri-areolar incision has been closed around the nipple areolar complex, leaving just a peri-areolar scar on the breast. A mirror-image procedure has been carried out for symmetry.



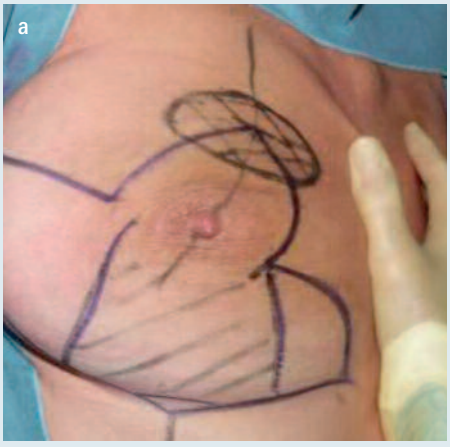
Source of figures: Krishna Clough

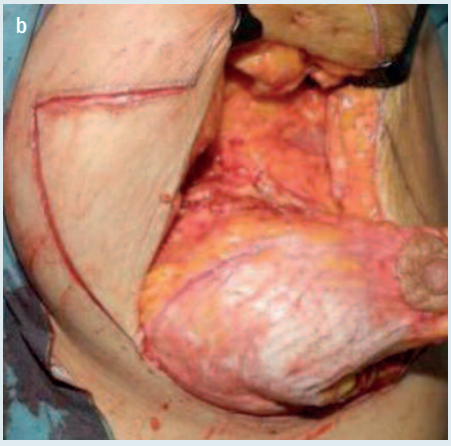
Figure d illustrates the tumour contained in the tissue, with a wide margin of excision, which would normally be discarded during a superior pedicle breast reduction technique. The surgeon will then mobilise the lateral and medial parenchymal flaps, and recruit them to reconstruct the resection defect in the lower pole of the breast (*figure e*). The skin flaps are then opposed and the nipple areolar complex is displaced into the new site (*figure f*) before the breast is closed. Finally, a contralateral mirror-image reduction mammoplasty is performed to achieve symmetry (*figure g*).

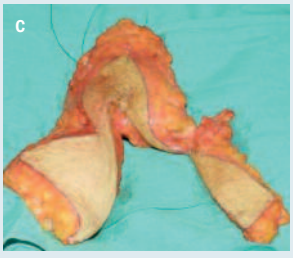


Inferior pedicle for upper pole tumour

These figures show a patient who had a phyllodes tumour in the upper pole of the breast. This a difficult area in which to carry out a wide local incision without causing very significant cosmetic deformity. *Figure a* shows the preoperative mark-up, looking from the foot of the patient up towards the inferior pole of the breast. In the next figure (*b*), the inferior pedicle has been de-epithelised and displaced, with the surgeon going up to resect the tumour in the upper part of the operative field. *Figure c* shows the resection specimen that has been removed from the patient, with the marker sutures shown on the upper part of the specimen, so that the pathologist can orientate the margins. A contralateral procedure was performed at the same time to achieve symmetry in the operative procedure (*figure d*). *Figure e* shows the patient six months later, demonstrating a reasonable cosmetic result.







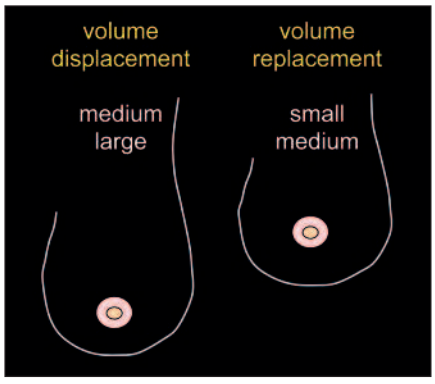
net loss in volume of the breast so, although the shape of the breast is good, the volume of the affected breast is less than the other side. Because of that, it is common to carry out a mirror-image procedure to match the breasts.

In volume replacement techniques, the defect caused by the tumour resection is reconstructed, usually with autologous tissue from outside the breast, so you are importing volume into that defect, which is moved and sutured into the gap. The big difference here is that the volume of the breast is much the same as before surgery, and sometimes a little greater. Because of this, there is no need for a contralateral procedure to achieve symmetry.

Which do you choose?

In broad terms, volume displacement techniques are most suitable for those patients with medium to large, heavy, ptotic breasts, who can afford to lose volume from the breast. They may benefit physically from loss of volume. It may also facilitate postoperative radiotherapy.

Volume replacement may be more suitable for patients who have small- to medium-sized breasts who cannot afford to lose volume or who may not want to. It is also suitable in women who wish to stay the same size and shape and those who do not want an operation on the other breast to achieve symmetry.



Factors influencing choice of procedure

Volume replacement techniques

There are two main volume replacement techniques. The first uses a myocutaneous latissimus dorsi (LD) miniflap, although the flaps may not be that 'mini' in some patients. The second uses a myosubcutaneous LD flap. These techniques have been around for a long time, and were first described by Pearl and his colleagues in Stanford (1985). They were popularised by Werner Audretsch in Düsseldorf (1998), and he has been the main driver in the development of these techniques in clinical practice.

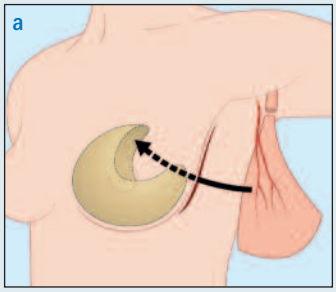
Myocutaneous LD miniflap

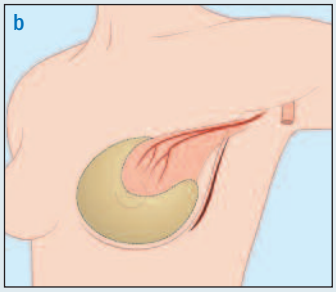
These techniques are used, largely, to reconstruct defects in the central and lower pole of the breast. They are carried out using a myocutaneous flap (*figure a*), which carries a skin island that can replace the skin that has been resected over the tumour. If this is in the middle of the breast, then it may be the skin of the nipple areolar complex. *Figure b* shows the flap lying in the breast, with the breast being reconstructed. These techniques are not generally used to reconstruct defects in the upper pole of the breast, because the skin colour may differ.

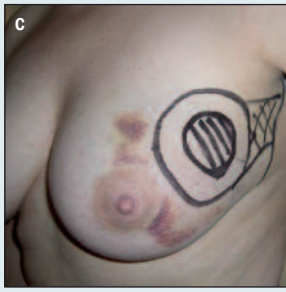
Figure c shows a patient with a very bulky 3.8 cm tumour in the central part of her breast. It was a high-grade, 7.5 cm, intraduct carcinoma with ductal invasive components, which turned out to be node positive. The patient did not want to have a mastectomy. Instead, she underwent a central resection of the tumour. *Figure d* shows the tumour specimen, which weighed 280 g and was 9 cm in diameter. This left a very large resection defect in the central part of the breast (*figure e*), but the breast tissue around it was normal, both oncologically and physically.

Myosubcutaneous LD flap

The other type of volume replacement surgery is with a myosubcutaneous latissimus dorsi flap. This is a myonic flap which does not have any skin on it (*figure a*). This was first described in Japan by Noguchi and colleagues (1990), and popularised by our group (Rainsbury et al. 1994). The difference between this and the above technique is that the whole operation can be performed through a single incision laterally (*figure b*) – tumour resection, flap harvest, axil-







The distribution of scars will also differ. Volume displacement generally results in scars on both breasts to achieve symmetry, but volume replacement will generally lead to scars only on the operated breast and possibly on the back, depending on the type of procedure used to reconstruct the defect. Theatre time is

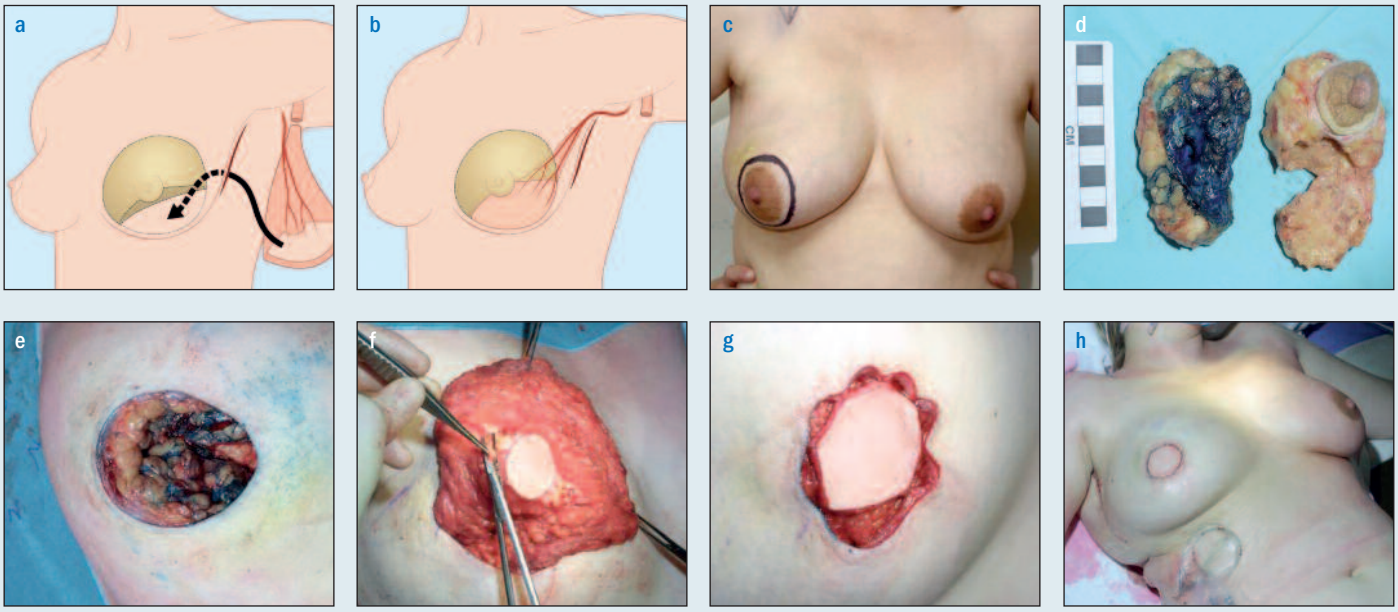
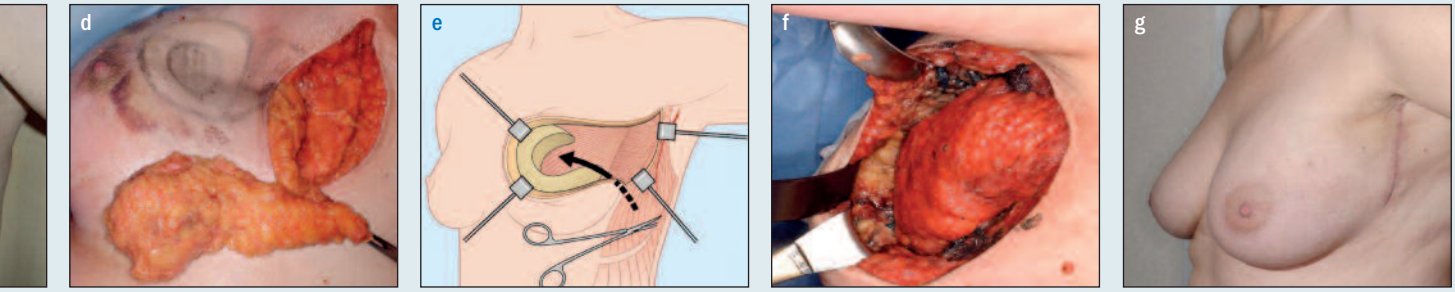


Figure f shows a flap being modelled, with a circular skin island being carried on in the flap. In *figure g*, the skin island is being sutured into place in the central part of the breast, and *figure h* shows the finished reconstruction of the resection defect. This patient had about 50% of her breast removed, but the remaining breast moved normally and felt normal in the periphery of the reconstruction.

lary dissection and reconstruction can be carried out through that single lateral incision.

Figure c shows a patient in her early 40s, with a bulky tumour in the upper outer quadrant, which was grade 3 and node positive. *Figure d* shows the tumour resection, with the tumour weighing over 250 g together with the surrounding tissue, with clear margins and the resection defect behind. In *figure e*, the flap is mobilised through the lateral edge of the incision together with some subfascial fat on the flap's surface. *Figure f* shows the flap modelled and sutured into the resection defect, while *figure g* shows the patient three weeks after surgery about to start adjuvant chemo- and radiotherapy.



shorter for volume displacement surgery if you have two teams of surgeons who are able to operate simultaneously on each breast, who may be able to carry out a procedure in less than two hours. Volume replacement is more major surgery, which may require between two and three hours of operating time.

Complications differ with the two techniques. Displacement procedures may be associated with ischaemia of the parenchymal flaps if the bases of the

Fiona MacNeill (FM), an oncoplastic breast surgeon working at the Royal Marsden Hospital, London, and senior tutor at the Royal College of Surgeons England, hosted a question and answer session with Dick Rainsbury (DR).

FM: *Oncoplastic surgery is undoubtedly the future for breast surgery. But this is complex surgery, not to be taken up without adequate training, otherwise we will have catastrophic problems as have occurred with surgeons performing breast reconstruction without adequate training. Would you like to comment on training in oncoplastic surgery?*

DR: Oncoplastic surgery puts together two quite different angles of surgery – resection and reconstruction. Traditionally, surgeons have trained as resectionists, as general surgeons, or as gynaecologists with an interest in resection in breast cancer treatment, or they come from a background of reconstructive or plastic surgery. There are lots of different models both in Europe and in other parts of the world.

In the UK we have developed a new curriculum and training scheme that teaches surgeons with an interest in this field the skills of resection and reconstruction from the beginning, recognising that this healthcare model makes a lot of sense. While the management of the patient may be multidisciplinary in nature, the skills required for the surgery are deployed at the same time. In terms of economy, it helps to cut down the costs and the time. The development of the necessary skills is being accelerated in the UK, as surgeons with an interest in breast surgery have come together with plastic surgeons to learn the skills.

This model is also beginning to develop in other countries, although we have a long way to go yet. In the UK, as patients are becoming familiar with it, they are asking for surgeons who are able to do these procedures at the same time. It is a very exciting field and something that we feel will be a major development in breast surgery in the future.

FM: *Some people argue that one surgeon should perform this type of surgery, because only one surgeon can do the same operation on both sides. What are your comments on the practicalities of scheduling?*

DR: That is a very relevant issue, and the more you become familiar with these procedures, the more you realise there are time constraints involved. If you are performing volume displacement type of surgery, where you need to do a procedure on the opposite breast to achieve symmetry, you need two teams of surgeons working alongside each other. Otherwise, surgeons providing a breast cancer resection service may find they fall behind and are not going to finish their operating list in time.

This is very important in planning, in teamwork, and in multidisciplinary management. If you have a plastic surgeon, or an oncoplastic surgeon, who can join you to do these procedures, then you will be able to speed up the time in theatre.

FM: *This is a very important point, particularly regarding working with a local plastic surgeon, rather than with breast surgeons, who may not be trained in the full range of oncoplastic techniques.*

DR: These oncoplastic techniques require the skills and knowledge of breast reduction techniques, which can be quite difficult to acquire, and also surgeons need to hybridise the skills of tumour resection, which can have an effect on the pedicles that are being raised. The surgery can become quite exacting and complex and involves very complex decision making in planning the surgery.

FM: *It has been tremendous to see two different professional surgical groups come together in the interests of the patients over the last five to ten years. There is no doubt that this is going to represent the future. There are a few technical questions on the techniques that have been described. For the miniflap, the myosubcutaneous flap, which is performed through a lateral incision without the removal of any skin from the back, do you require any special instruments, because it is presumably quite difficult to harvest the muscle from the curved rib cage?*

DR: You do require special instruments and you also require good experience in latissimus dorsi reconstruction, as well as a good assistant, because one of the problems is that you are working round a rigid, convex surface with instruments that are traditionally straight and rigid. It is crucial to have a good position on the table. As for all forms of keyhole surgery, you need to have excellent retraction, good lighting, good cutting equipment, good coagulation equipment and, above all, a good assistant. You must have patience while you are performing the operation, because it is not the easiest surgical procedure to carry out. And you need to be skilled in these techniques if you want to be able to harvest the maximum amount of tissue.

FM: *Another technical point is the issue of margins with a myocutaneous flap procedure. One of the criticisms that has been levelled at this technique relates to how confident surgeons can be that they have clear margins. You have burnt your boats using a very useful flap, which can often be used for other salvage procedures in the future. How do you get round the* ▶▶

flap are too narrow. This may lead to flap necrosis, which may delay or interfere with adjuvant treatment. Complications with volume replacement may be due to the donor site. Other problems include infection, haemorrhage or, unusually, there may be loss of blood supply to the flap, which in turn, will lead to complications and delay of adjuvant treatment.

Technical aspects

Volume displacement techniques are based on well-established methods of breast reduction or reduction mammoplasty:

- superior pedicle
- round block
- inferior pedicle

Volume replacement techniques also fall into three main subgroups, using either:

- myocutaneous flaps of latissimus dorsi
- myosubcutaneous flaps of latissimus dorsi, or
- lateral adipose tissue

Clinical outcomes

A summary of the studies published with volume displacement and volume replacement techniques by the end of 2007 is shown in the table below, with two or three more publications since then. They were mainly small, retrospective studies of just over 600 patients *in toto* who underwent either volume displacement or volume replacement.

	volume displacement	volume replacement
studies (no)	11	7
patients (no)	189	433
follow up (mo)	21-54	24-53
local recurrence (%)	0-7	0-5
cosmetic failure (%)	0-18	0-9

There are three important issues. First, the follow-up is not very long, being only two to just over four years. Local recurrence rates ranged from 0 to 7%, and cosmetic failure rates from 0 to 18%–20%. This compares reasonably favourably with mastectomy, bearing in mind that these patients would generally have been treated by mastectomy in the past. These results are encouraging, but none of these studies were prospective and we do not yet have longer follow-up or long-term data on either the clinical or the oncological outcomes of these patients.

In conclusion

There is increasing interest, particularly as we are offering more breast conservation, in looking at how we can improve the cosmetic outcome for a very large number of women across the world. The main rationale for breast conservation is an improved or good aesthetic outcome, yet there is a serious cosmetic morbidity for many women who have breast conservation. Breast-conserving reconstruction provides an exciting and innovative approach to the surgical treatment of early breast cancer, offering a third option to mastectomy or breast-conserving surgery. In our own practice, many patients who would otherwise require mastectomy are now treated by breast conservation. Patients find the techniques very agreeable, because they preserve normal breast sensation, breast movement and breast feeling. They also avoid the more major surgical techniques that require full mastectomy and full reconstruction, and also the use of implants and the complications that can result. However, it is still early days. Early studies have shown encouraging results but, as yet, we have no data on long-term oncological and cosmetic outcomes.

issues of margins? Do you do any intraoperative assessments?

DR: This is an important point that also applies to volume displacement techniques. It is important to remember that these operations on the breast are much more than we would normally do. If patients have a positive margin, you need to do something else to clear it. However, there are ways of developing margin analysis during surgery. In Italy and France, margin analysis has traditionally been done using frozen sections, although not in the UK. However, my own unit, and others, are starting to use this approach, and there are reliable ways of using frozen sections.

If the pathologist then finds an area involved that you have missed, with volume replacement surgery you can displace the flap and resect the margin that is positive, providing you've marked the specimen correctly. With volume displacement, there is a bigger margin to look at, but because you have resected so much tissue, it is uncommon to find that anything has been missed. If you do find a margin involved, you probably have to go back and do a mastectomy.

FM: *This emphasises the importance of imaging before procedures.*

DR: I think we will see more sophisticated imaging, such as MRI, to carefully map out the tumour before surgery.