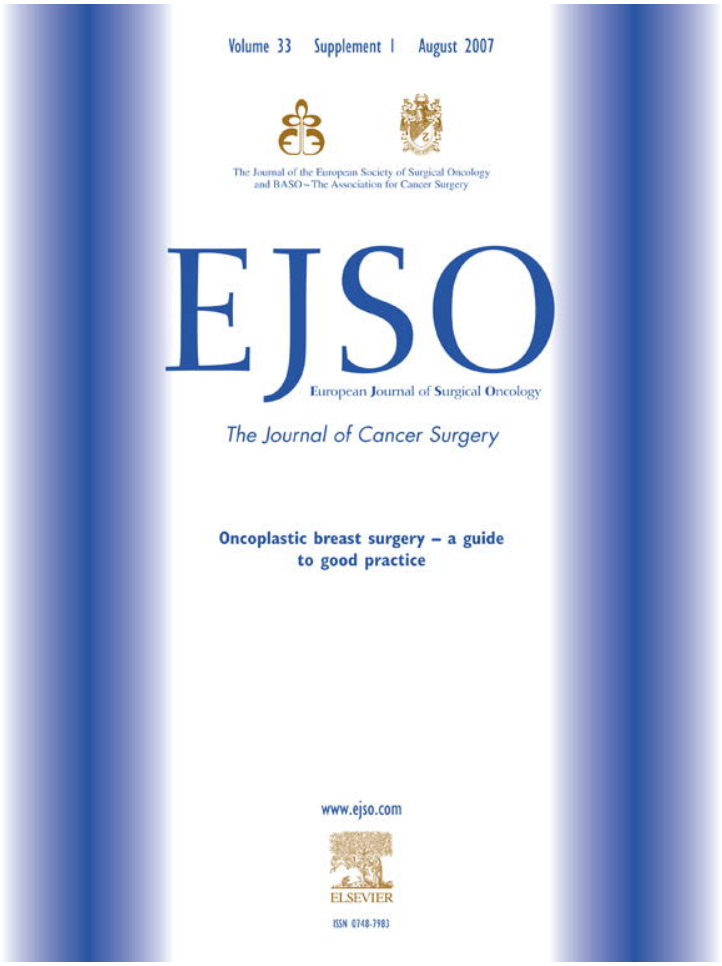

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Oncoplastic breast surgery – A guide to good practice

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Keywords: Breast; Breast cancer; Reconstruction; Oncoplastic; Guidelines

Introduction

Breast reconstruction is becoming increasingly important due to changes in patient expectations and demand. There is growing recognition that immediate reconstruction in appropriately selected women can combine an oncological and aesthetic procedure in one operation with excellent results. Because most breast surgery is performed by general surgeons, most reconstructions were performed as delayed procedures by plastic surgeons. Increasingly, breast surgery is being performed by breast surgeons trained in oncoplastic techniques who can offer immediate reconstruction with both therapeutic and economic benefits.[1] [V], [2] [III]

These guidelines have been written to assist with the setting up and delivery of an oncoplastic breast service. The decision to commission them was taken by the then BAPS/BASO Interface Group on behalf of the British Association of Surgical Oncology (BASO) and the British Association of Plastic Surgeons (BAPS) and the leading role played by Douglas Murray, Chris Khoo, Dick Rainsbury and others is acknowledged. Results of randomised controlled trials are sparse in oncoplastic surgery but such evidence as there is and its level (I–V) is quoted after each reference.

I commend this guidance to all involved in this complex branch of breast surgery.

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A statement of purpose

For whom is this document intended?

This document is for women with breast cancer, and all those involved in their care to ensure the highest standards in setting up and delivering an oncoplastic breast service.

Defining the service

The Breast Oncoplastic Service is defined as a core component of the breast multidisciplinary team with sufficient experience to offer patients access to the full range of procedures encompassed by oncoplastic breast reconstructive surgery, which include:

- Appropriate adequate surgery to extirpate the cancer
- Partial reconstruction to correct wide excision defects
- Immediate and delayed total reconstruction with access to a full range of techniques
- Correction of asymmetry of the reconstructed and the contralateral unaffected breast.

It is envisaged the service will rely on inter-specialty collaboration across sites. Essential components of the service include:

- Multi-disciplinary team (MDT)[3] [IV]
- Administration
- Clinical skill mix
- Resources
- Data collection
- Clinical governance

• Education and training.

The following sections expand on these points. An oncoplastic service will also consider the evolution of a surgical career. Consideration needs to be given to the needs and requirements of newly appointed and mature surgeons as well as those surgeons in the latter stages of their career.

The patient's journey

Diagnosis

All women with suspected breast cancer should undergo formal assessment and investigation in accordance with practice defined in the NHS Breast Screening Programme (www.cancerscreeing.nhs.uk/breastscreen) guidelines or guidelines for symptomatic women produced by the ABS at BASO.[3] **[IV]**

Decision-making

Decisions about immediate reconstruction may have to be made by the patient and her surgeon before the risk of local recurrence and the likely use of radiotherapy is known.[4,5] **[III]** Decisions about reconstructive surgery must:

- not compromise oncological principles;
- consider risk factors evident in the individual concerned, particularly smoking, obesity, diabetes, hypertension, co-morbidity and complications of previous surgery such as deep vein thrombosis;
- take into account the potential delay in adjuvant treatment which may occur as a result of complications;
- consider how adjuvant treatment may adversely affect the outcome of reconstruction.

The oncoplastic team must ensure that the patient has adequate time:

- to make an informed decision;
- to be supported by an appropriately trained specialist nurse;
- to satisfy their information needs;
- to have an opportunity to meet other patients who have, or have not, undergone oncoplastic surgery;
- to view a range of educational materials, including images of a variety of reconstructive techniques;
- to discuss perceived risks and benefits;
- to discuss the full range of additional procedures that may be required.

This implies that the patient will frequently require more than one preoperative consultation.

The team must also ensure that:

- patients contemplating oncoplastic surgery have realistic expectations about the outcome of breast reconstruction;
- patients are aware of the potential long-term implications of oncoplastic surgery;
- patients are aware that complete breast reconstruction including the nipple–areola reconstruction may require several separate surgical procedures[6] **[IV]**;
- women who decide against immediate reconstruction should be reassured that they can discuss delayed reconstruction subsequently.

Women who find the decision about reconstruction particularly difficult may benefit from referral to a psychologist to help them through the decision-making process. It may be preferable for these women to consider reconstruction as a delayed procedure.

Deciding upon and undergoing breast oncoplastic surgery may be stressful and can have profound psycho-social sequelae. Members of the breast care team can help to alleviate the impact of these decisions by developing an ethos of care in which psycho-social and appearance-related concerns can be freely raised and addressed.[7] **[III]**

Adjusting to an altered body image after breast reconstruction can be a lengthy process and may never be fully resolved. The patient has to adjust to: scarring, altered or loss of sensation, changes at any donor sites, concerns about implants and complications of surgery.[8] **[III]**, [9,10] **[III]**

The patient's own perceptions about the results of her surgery may not concur with the perception of a third party. Any decisions regarding further surgery to enhance the aesthetic result of surgery must be made by the patient, after consultation with the reconstruction team.

It is important to recognise that the experience of oncoplastic surgery will also have an impact upon the patient's partner and family, who may also need access to information about reconstructive surgery and support through the process.

Consent

Informed consent should follow nationally established guidelines (ref: www.doh.gov.uk/consent; Good practice in consent: achieving the NHS Plan commitment to patient centred consent practice).

Perioperative preparation and anaesthesia

Introduction

Oncoplastic surgical operations are often long and frequently complex. As so often in surgical practice, careful patient selection (which factors in both co-morbidity and patient expectation) is the key to success.

Preoperative assessment

This should pay particular attention to cardiovascular disease, respiratory disease, obesity, smoking and diabetes. These are known to increase the risks of surgery, especially cardiac events, chest complications, deep venous

thrombosis, skin and flap necrosis, wound infection and delayed healing.[11–19] [II–IV]

Intraoperative management: general principles

Particular attention should be paid to correct positioning of the patient with the appropriate operating table attachments thereby preventing pressure sores, maintaining perfusion pressure and the avoidance of hypothermia.[20] [II]

Post-operative care

All staff should be aware of the importance of observation, especially of changes in colour and temperature of a transposed flap (see Appendix E for flap monitoring chart). Appropriate physiotherapy should be started post-operatively (see Appendix D on physiotherapy).

Discharge process

The discharge process should be planned and should include:

- an explanation of the importance of early signs of complication and action to be taken should they arise;
- arrangements for access to the team including a contact telephone number;
- a date for a clinic visit.

Subsequent management

Arrangements for subsequent review by appropriate members of the multidisciplinary team should be made including:

- a plan for tissue expansion;
- outpatient physiotherapy (see Appendix D);
- attendance for wound inspection and seroma aspiration;
- psycho-social support.

Following tumour excision, the histopathological results must be discussed at the multidisciplinary meeting (MDM). The decisions reached will be discussed with the patient and an adjuvant therapy and follow-up programme will be agreed.

Selection of breast reconstruction techniques

Historically, the goals of breast reconstruction were to improve the appearance when clothed and to avoid an external prosthesis. Surgical advances and increased patient expectations have modified these goals. The current aim is to produce symmetry that satisfies the patient's wishes within the limits of technical feasibility, whilst matching the remaining breast in terms of its contour, dimension and position. This may involve the use of breast implants and the use of corrective surgery to the opposite breast.

Breast-conserving surgery and reconstruction

Rationale

Poor planning in breast-conserving surgery can result in unacceptable deformity. Thought must be given to the likely cosmetic result and the impact and timing of additional treatment. Plastic surgery techniques can be used to remodel the conserved breast and surgery to the opposite breast can be anticipated to achieve better symmetry.[21] [V] The use of implants to correct volume deficiency can lead to bad results.[22] [IV]

Oncoplastic techniques extend the scope for breast-conserving surgery by combining an extensive local excision of the breast parenchyma with a simultaneous reconstruction of the defect to avoid local deformity.[23] [V]

Indications

Breast-conserving surgery and reconstruction should be considered in those patients where adequate local excision cannot be achieved without significant risk of local deformity.[24] [V] This frequently occurs after:

- resection of more than 20% of the breast volume;
- central, medial and lower pole resections;
- axillary dissection through lumpectomy incision;
- periareolar incisions in inferior quadrants;
- incomplete mobilisation of breast parenchyma to allow reshaping of the breast.

Other indications include women considering a breast reduction in addition to excision.[25] [III]

Deformities in patients who have had poorly planned conservation treatment are often severe and difficult to manage.[26] [V] Subsequent reconstruction of these deformities result in a higher risk of complications and recurrent deformities and are only improved in 50% of patients.

Salvage mastectomy is not easily accepted by these patients. Every effort has to be made to avoid these late deformities at the time of the original surgery.

Contraindications

Breast-conserving reconstruction is contraindicated:

- when clear margins cannot be assured without performing a mastectomy;
- in patients with T4 tumours;
- in those patients with multicentric disease;
- in patients with extensive malignant mammographic microcalcification;
- in patients with inflammatory carcinoma.

Timing of procedure

Breast-conserving surgery and reconstruction can be performed as a one-stage procedure, or as a two-stage

procedure to allow formal margin analysis.[27] [V] Patients opting for a one-stage procedure must be informed preoperatively of the potential for further surgery if positive margins are reported.

Technique selection

Reconstruction following breast-conserving surgery may be carried out using volume replacement or volume displacement techniques.

Volume replacement. Autologous tissue is harvested and transferred from a remote site into the resection defect, replacing the volume of excised breast tissue. This commonly involves the use of latissimus dorsi (LD) flaps. As the volume is restored, contralateral surgery is rarely required to achieve symmetry. Complications include donor site morbidity, shoulder dysfunction and flap loss. Should a mastectomy be required at a later date, LD reconstruction cannot be used.

Volume displacement. Local glandular or dermoglandular flaps are mobilised and transposed into the resection defect. This leads to a net loss in breast volume and the potential need for a simultaneous contralateral reduction to achieve symmetry. The resection of the tumour can be combined with a range of mammoplasty techniques including:

- Glandular remodelling
- Inferior pedicle techniques
- Superior pedicle techniques
- Vertical scar techniques
- Round block techniques
- Grisotti flaps

Volume displacement is associated with the recognised complications of conventional reduction mammoplasty including parenchymal flap necrosis, nipple/areola necrosis, wound breakdown and potential cosmetic failure.

Follow-up after combined reconstruction and breast-conserving surgery. Wide local excision and reconstruction of the resulting defect by volume replacement or volume displacement and adjuvant radiotherapy may alter the mammographic appearance. There is no evidence that breast conserving reconstruction interferes with surveillance. Nevertheless additional imaging modalities such as ultrasound or MRI scanning may be required.

Reconstruction after total mastectomy

Timing of reconstruction

The fundamental aim of surgery must be to provide safe and successful oncological treatment. Breast reconstruction, whether immediate or delayed must acknowledge the primacy of the breast cancer. A reconstruction service exerts its impact in two ways. Immediate reconstruction often requires co-ordination of a bigger team with greater pressure on theatre time. When delayed reconstruction cannot be performed within a reasonable timescale, patients may opt to be treated elsewhere. In this case it is imperative that continuity of care is ensured by proper clinical governance.

Immediate breast reconstruction. Published evidence to date indicates that immediate breast reconstruction does not adversely affect breast cancer outcome.[28] [III], [29] [V] The reconstruction does not interfere with further treatment for advanced cancer and there is no significant difference in the survival rates between immediate or delayed reconstruction.[30] [V], [7] [III], [31] [III], [32] [III] Adjuvant chemotherapy and radiotherapy may have detrimental effects on some types of breast reconstruction but these can be minimised by judicious choice of type and timing of the oncoplastic technique.[33] [III], [29] [V], [34] [III]

Advantages of immediate breast reconstruction:

- Potential for a single operation and period of hospitalisation
- Maximum preservation of breast skin and preservation of the inframammary fold[35] [III], [36] [IV], [37] [V]
  - Good quality skin flaps, which are unscarred and have not endured radiotherapy
  - Better cosmetic results in skin-sparing mastectomy
  - Reduced need for balancing surgery to the contralateral breast
  - Lower cost than delayed reconstruction[2] [III]

Disadvantages of immediate reconstruction:

- Limited time for decision-making
- Increased operating time
- Difficulties of co-ordinating two surgical teams when required
- A potential in individual patients for complications to result in the delay of adjuvant treatment
- That the need for adjuvant treatment cannot always be predicted prior to surgery.

Delayed breast reconstruction. Advantages of delayed breast reconstruction:

- Allows unlimited time for decision making
- Avoids any potential delay of adjuvant treatment
- Avoids detrimental effects of radiotherapy or chemotherapy on the reconstruction

Disadvantages of delayed breast reconstruction:

- Requires replacement of a larger amount of breast skin
- Mastectomy flaps may be thin, scarred, contracted or irradiated and poorly positioned

- May result in a less aesthetically pleasing outcome
- Requires separate episode of hospitalisation
- Increased treatment cost compared to immediate reconstruction
- Scheduling difficulties may occur

Contraindications for breast reconstruction

- Non-resectable local chest wall disease
- Rapidly progressive systemic disease
- Patients who have serious co-morbidity
- Patients who are psychologically unsuitable

Techniques of breast reconstruction

The ideal breast reconstruction is a soft natural feeling breast which maintains its characteristics over time, has a natural fluidity and a permanent and natural inframammary fold.

Implant based techniques require limited surgery initially but have certain limitations and are not always quick and trouble-free. These procedures allow patients some control over breast size, but the quality of the long-term result is directly related to their tolerance of breast implants. Further procedures may be required for complications and maintenance. The aesthetic results from autologous reconstruction are superior to those of implant based reconstruction due to their versatility, their more natural appearance, consistency and durability. Autologous tissue can better withstand radiotherapy.[38] [III]

The autologous latissimus dorsi flap is highly versatile and has acceptable donor site morbidity. The skin and fat of the lower abdomen are ideal for autologous breast reconstruction but donor site morbidity is increasingly being appreciated. Muscle sparing techniques preserve the abdominal wall function at a cost of a more complex procedure. The effects of adjuvant radiotherapy on breast reconstruction using lower abdominal tissue are still under investigation.

The choice of technique depends on:

- Patient fitness for surgery
- Breast size
- Body habitus
- Laxity and thickness of remaining breast skin
- Condition of the underlying muscles
- Availability of donor flap sites
- Stage of disease
- Perceived need for adjuvant radiotherapy
- Patient preference if more than one reconstructive option is feasible[39] [IV], [40] [V], [41] [III]

Tissue expansion and implant reconstruction

Replacement of the breast volume with an implant or a tissue expander is the simplest method of breast reconstruction.[42] [IV] Patient selection and implant selection are crucial. Several techniques are possible:

- Fixed volume implant (single stage)
- Variable volume expander-implant (single stage)
- Tissue expansion followed by permanent implant (two stage)

Advantages of tissue expansion:

- Simple and flexible technique
- May not involve additional scarring
- Breast is reconstructed with local skin
- Allows insertion of larger implants
- Shorter procedure
- Shorter convalescence and rehabilitation
- Does not preclude further reconstruction options
- Avoids donor site morbidity

Disadvantages of tissue expansion reconstruction:

- Multiple staged procedures
- Multiple hospital visits for expansion
- Added complications of implants
- Need for revisional surgery
- Lack of projection
- Limited ptosis
- Less likely to achieve symmetry
- Less satisfactory long-term cosmetic outcome
- Capsular contracture particularly after adjuvant radiotherapy[43] [IV], [44] [III], [45] [III]

Indications for tissue expansion[40] [V]:

- Patient of normal body mass index (BMI)
- Small to moderate non-ptotic breasts
- Good soft tissue cover, intact pectoralis major muscle
- Bilateral reconstruction
- Patients who are unwilling or unfit to undergo autologous tissue reconstruction

Contraindications for tissue expansion[40] [V]:

- Chest wall tissues are thin, damaged, inelastic or irradiated
- Extensive infra-clavicular tissue deformity or a vertical mastectomy scar
- Mastectomy skin deficit >8 cm
- Radical mastectomy defect
- Patients who have unresolved concerns about the use of implants

The complications of implant/tissue expansion:

- Complications related to wound failure
- Haematoma
- Wound infection

- Breast skin necrosis
- Wound dehiscence
- Implant failure
- Complications of breast implants
- Capsular contracture
- Asymmetry
- Displacement
- Thinning of the overlying skin[30] [V], 46 [IV], 47 [V], 48 [IV], 49 [IV]

Latissimus dorsi flap

The latissimus dorsi myocutaneous flap allows for the immediate or delayed reconstruction of a full range of breast volumes. It has particular advantages for patients with larger or more pendulous breasts. This technique can also be used for salvage surgery and chest wall reconstruction.[40] [V], 50 [V], 51 [V], 52 [V]

Several variations of this technique are possible:

- Muscle only flap, without a skin island
- Myocutaneous flap with or without a breast implant or tissue expander
- Extended LD flap reconstructing the whole breast with autologous tissues only, avoiding the use of implants or tissue expanders
- Muscle sparing or perforator based techniques[53–55] [V]

Advantages of the latissimus dorsi flap:

- Versatile
- Reliable technique
- Dependable tissue perfusion

Disadvantages of LD flaps:

- Donor site scar and contour defect on back
- Different skin colour between back and breast
- Possible shoulder impairment

The functional deficit after transfer of an LD muscle affects some specific activities like rowing, cross country skiing or mountain climbing but appears to have little effect on most other activities.[40,51,52] [V], 56–59 [III] Additional physiotherapy may be required to restore full shoulder mobility (see Appendix D).

Indications for LD flaps:

- Chest wall tissues that are unsuitable for tissue expansion
- Additional tissue requirements after mastectomy
- Chest wall reconstruction
- Partial breast reconstruction (after conservation surgery or partial or total loss of abdominal tissue flap)

Contraindications for LD flaps:

- Previous surgery which may have compromised the vascular supply to the flap
- Patient co-morbidity
- Absence of latissimus dorsi muscle

Post-operative complications:

Flap related

- Haematoma
- Infection
- Partial or total flap necrosis
- Delayed healing
- Expander failure
- Complications of breast implants

Donor site related

- Haematoma
- Infection
- Skin loss
- Delayed healing
- Persistent seroma[35,60] [III]

The use of silicone expanders and breast implants

All available information on the safety of silicone has been assessed by the Independent Review Group and the findings have been published in a report in 1998 (www.silicone-review.gov.uk, Level IV).

There is currently less information about the actual lifespan of an implant. Any patient receiving an implant or tissue expander based breast reconstruction has to be aware that the implant may require replacement.

Breast reconstruction with lower abdominal tissue

The lower abdomen is often an abundant source of tissue for autologous breast reconstruction. A sizeable and natural feeling breast mound can be created without an implant or tissue expander using tissue which is usually discarded during an aesthetic abdominoplasty procedure. The final appearance of the donor site defect is often acceptable and in some cases may offer a cosmetic improvement. Though this technique can provide excellent long-term results, donor site morbidity should not be underestimated.[61] [III]

The triple blood supply to the lower abdominal tissue allows it to be used in a variety of techniques.[52] [V], 62 [V], 63 [IV], 64–68 [V]

- Pedicled transverse rectus abdominis myocutaneous flap (TRAM)
- Free transverse rectus abdominis myocutaneous flap (TRAM)
- Free deep inferior epigastric perforator flap (DIEP)
- Free superficial inferior epigastric artery flap (SIEA)

Surgeons have moved from pedicled TRAM flaps to free perforator flaps to try to reduce the morbidity of the donor site and preserve abdominal wall integrity and function. The

complications encountered with techniques using lower abdominal tissue for breast reconstruction are related to

- the extent of muscle resection;
- extent of fascia resection;
- the use of a mesh to repair the abdominal wall.

These factors should be borne in mind when selecting the appropriate procedure for an individual patient. All these techniques will interfere with abdominal wall sensation.

Indications for breast reconstruction using lower abdominal tissue include:

- Sufficient lower abdominal tissue
- Large contralateral breast
- Divided or atrophic latissimus dorsi muscle
- Previous complications with implant based reconstruction
- Bilateral breast reconstruction

Contraindications for lower abdominal flaps

Reconstructions using lower abdominal tissue can be associated with significant complications and morbidity, and are contraindicated in the following circumstances.[69–71] **[III]**

- Physiologically unfit patient
- Patients with significant co-morbidity including obesity, diabetes, autoimmune disease, vaso-spastic disorders, cardio-respiratory disease
- Smoking
- Psycho-social problems
- Abdominal scars disrupting the vascular anatomy
- Inadequate recipient vessels in free tissue transfer patients

Pedicled TRAM flap. The pedicled TRAM flap relies on blood flow through the deep superior epigastric vessels within the substance of the rectus abdominis muscle to supply a horizontal ellipse of lower abdominal skin and fat. The flap is transferred onto the chest wall through a subcutaneous tunnel. It is not an appropriate technique for individuals in whom the distance from nipple to costal margin is greater than the distance form the costal margin to the umbilicus (short-waisted women).

Advantage of pedicled TRAM compared to free TRAM flap:

- No need for microvascular transfer

Disadvantages of pedicled TRAM compared to free TRAM flap:

- Harvesting of large amount of muscle
- Reduced vascularity of the flap
- Higher incidence of fat necrosis
- Reduced abdominal wall function
- Long recovery time
- Costal nerve compression
- Complications of a mesh, if used to repair the abdominal wall

The development of reliable free tissue transfer techniques has provided an alternative to the pedicled TRAM flap in an attempt to reduce abdominal wall damage and lower the risk of partial or total flap necrosis.[72] **[V]**, [73,74] **[III]**

Free TRAM flap. The deep inferior epigastric vessels are the dominant blood supply for a free TRAM flap. The lower abdominal skin is transferred with a segment of rectus abdominal muscle and the deep inferior epigastric vessels, which are then anastomosed to recipient vessels of the subscapular axis or the internal mammary system.[65] **[V]**

Advantages of free TRAM flap:

- Better tissue perfusion compared to pedicled TRAM flap
- More appropriate for larger breasts
- Longer vascular pedicle compared to other free flaps
- Larger vessel diameter for microsurgical anastomosis
- Smaller amount of muscle harvested than in the pedicled TRAM
- Reduced blood loss

Disadvantages of free TRAM flap:

- Requires microsurgical techniques and the infrastructure to support the use of those techniques
- Longer duration of operation than pedicled TRAM

Free tissue transfer is a major surgical procedure with an increased risk of general complications. Specific complications of free TRAM flaps can be related to the flap or the donor site.[75] **[V]**, [76] **[III]**, [77,78] **[V]**, [79] **[III]**, [80] **[V]**

Flap related complications of free TRAM flap:

- Microsurgical problems
- Haematoma
- Partial flap loss
- Total flap loss
- Fat necrosis
- Delayed healing

Donor site complications of the free TRAM flap:

- Haematoma
- Wound infection
- Problems with mesh closure
- Asymmetry of umbilicus
- Bulging abdominal wall
- Hernia
- Abdominal weakness

Free DIEP flap. The free DIEP flap spares the whole of the rectus abdominis muscle. No muscle or fascia is harvested and no mesh is required for donor site closure.

The flap relies on the meticulous dissection of perforating vessels within the rectus abdominis muscle.[66,67] [V]

This technique is particularly indicated for young, athletic patients and those women requiring bilateral breast reconstruction. The DIEP flap has all the potential flap complications of any free tissue transfer but reduces donor site complications and morbidity.

Advantages of perforator flap breast reconstruction:

- Only skin and fat harvested, muscle preserved
- Comparable outcomes with the free TRAM flap
- Preservation of abdominal and back extensor muscle strength[81–83] [III]

Disadvantages of DIEP flap:

- Increased operating time
- High level of surgical expertise requiring specialised training in dissection techniques

Flap related complications of free DIEP flap:

- Microsurgical problems
- Haematoma
- Partial flap loss
- Total flap loss
- Fat necrosis
- Delayed healing

Donor site related complications of free DIEP flap:

- Haematoma
- Wound infection

The free SIEA flap. Harvesting the SIEA flap does not disturb the rectus abdominis or the abdominal fascia. It relies on dissecting the superficial inferior epigastric (a branch of the femoral artery), and its vein, which supplies the fat and skin of the lower abdomen. Unfortunately, this vessel is absent in a third of patients and may have been damaged by previous surgery.[68] [V]

Advantages of the free SIEA flap:

- No dissection of abdominal wall muscle or fascia
- No risk of post-operative weakness
- Shorter operating time, easier dissection
- Less post-operative pain

Disadvantages of the free SIEA flap:

- Short pedicle
- Small diameter of vessels (1.5–2 mm)
- Higher rate of partial flap necrosis[84–86] [V]

Alternative free flap donor sites

There are further types of free flap transfer for breast reconstruction. However the expertise required for these is extremely demanding and the failure rates are potentially higher. They should be reserved for women in whom conventional techniques are deemed inappropriate.

Alternative options for autologous tissue breast reconstruction:

- Free superior and inferior gluteal perforator flaps
- Lateral transverse thigh flap
- Rubens peri-iliac fat pad flap
- Free latissimus dorsi flap from the contralateral side

These may be indicated if the lower abdomen or back have insufficient tissue, have already been used, cannot be used due to disruption of the vascular pedicles, or if the patients want to avoid scars in more obvious parts of the body.[87–90] [V]

Surgery to the contralateral breast

There are two situations in which contralateral surgery needs to be considered. One is where it is necessary to operate in order to achieve symmetry. The other is where a woman, deemed at high risk of contralateral breast cancer after a formal assessment of genetic risk, may consider a risk reducing mastectomy with reconstruction.

The resources for this additional surgery should be considered when setting up an oncoplastic service.

Complete breast reconstruction including the nipple–areola reconstruction will require on average 3.3 separate surgical procedures.[6] [V]

Additional procedures to the reconstructed breast

Further surgery may be necessary to the reconstructed breast.

Adjustment of size of reconstructed breast

- Liposuction
- Excision of excess tissue
- Mastopexy
- Augmentation

Adjustment of position of reconstructed breast

- Repositioning on the chest wall
- Revision of flap inset

Adjustment of shape of reconstructed breast

- Capsulotomy or capsulectomy for capsular contracture
- Correction of projection
- Adjustment to the inframammary fold
- Recreation of an axillary fold

- Scar revision
- Change of implant

Adjustment of flap donor site

- Scar revision
- Liposuction
- Treatment of seroma
- Repair of abdominal bulge/hernia

Treatment of involuntary muscle contraction

- Temporary paralysis or permanent division of nerves
- Physiotherapy
- Revision of reconstruction

Nipple–areola reconstruction

The final part of the breast reconstruction is the reconstruction of the nipple–areola complex. Some patients are happy with a prosthetic nipple but patients should be offered the opportunity to proceed to nipple reconstruction.[91] [III]

Techniques for nipple reconstruction:

- Prosthetic nipple
- Composite grafts
- Local flap reconstructions (multiple designs)

Techniques for areola reconstruction:

- Tattoo
- Full thickness skin grafts

Skin grafting has been abandoned largely in favour of tattooing, a relatively simple technique with few complications. Improved colour match can be achieved by the use of a 3D colour-chart.[92,93] [V] See Micropigmentation service.

Salvage surgery

Salvage surgery may be required for complications of the reconstruction or for oncological reasons.

Complications of breast reconstruction requiring salvage surgery

Where there has been breast skin flap loss the situation can be redeemed by the following techniques:

- Advancement of breast skin or flap and direct closure
- Split thickness skin graft
- Salvage with an LD flap

Implant extrusion due to wound dehiscence:

- Removal of implant and later reinsertion
- Conversion to an LD flap

Partial flap loss:

- Debridement and direct closure
- Split thickness skin grafting
- Further flap procedure (LD, thoracoepigastric flap)
- May require surgery to the opposite breast to achieve symmetry

Complete flap loss:

- Debridement and direct closure or split thickness skin graft
- Further flap procedure
- Insertion of tissue expander or implant

Local recurrence

Salvage surgery for chest wall recurrence often creates a surgical dilemma because although the patient has recurrence, they may have significant life expectancy. These reconstructions are often difficult because they rely on poor quality tissues.

The aims of surgery in this situation include:

- Local control of disease
- Palliation of symptoms
- Enhancing quality of life

Reconstruction of the resultant defect often requires extensive surgery in form of:

- local flaps or abdominal advancement;
- regional flaps such as latissimus dorsi, pectoralis major and parascapular flaps;
- pedicled or free abdominal flaps;
- a combination of the above techniques.

These complex procedures should only be carried out in a multidisciplinary setting offering the full range of reconstructive options.

Additional resources

Dedicated outpatient time

Patients require enough information to both make a decision and give informed consent about breast reconstruction. This is a resource intensive service and sufficient time must be available to:

- assess the clinical problem and describe the options;
- allow the patient to digest and understand the information given to them;
- consult with the breast care nurse;
- allow for additional consultations to confirm the decision before proceeding with surgery;

- carry out practical procedures such as the aspiration of seroma.

Dedicated operating time

Surgeons undertaking reconstructive surgery need adequate facilities. They should be supported by:

- access to an all day list;
- adequate assistance within the operating theatre;
- a theatre team familiar with the nature of the surgery;
- the facility to operate when necessary with a second team of surgeons.

Dedicated inpatient and high dependency beds

In units undertaking oncoplastic surgery:

- Provision should be made for a ward to have as one of its dedicated interests breast and reconstructive surgery.
- The staff of that ward to be given adequate opportunity to receive training and career development around such nursing.
- Patients undergoing reconstructive surgery should be admitted to the designated ward, with enough time for them to settle in, so that final assessments and skin marking can be made before surgery.
- There should be adequate facilities for post-operative monitoring commensurate with the type of surgery being performed. With appropriate facilities, this might be on the designated ward but may in some instances need access to a high dependency unit (HDU) facility or its equivalent.
- A protocol for post-operative management should be available on all wards.
- Ward facilities for out of hours consultations for recently discharged patients should be provided.

Medical photography

Medical photographs represent an important record, therefore, all patients undergoing reconstructive surgery should have a photographic record that documents the progress and is kept with the clinical notes.

Implant stock/system

The following points should be considered for a service providing implants:

- The quality, range, proven reliability and ready availability of prostheses.
- The supplier's ability and willingness to provide support training and education.
- Evaluation, reporting and compliance from the supplier for explanted products.
- Value for money, budgetary considerations and the level of implant stock required to cover the workload.

Implant stock

A full range of the selected types and sizes of implant should be available when the patient has her surgery. This can be provided economically by one or more of the following:

- *Purchased shelf stock*. Purchased stock is usually bought by the hospital and can provide either all the sizes needed or a core of sizes, which can be added to if a specific patient requires a less common implant.
- *Consignment or ''bank'' stock*. Consignment stock belongs to the supplying company and will be placed by mutual arrangement with a formal agreement signed according to policies. It is a consideration that this stock is the total responsibility of the hospital while it remains on their premises.
- *Sale or return stock*. Some suppliers offer a ''sale or return'' service where up to three sizes can be ordered for each procedure. After surgery the unused product is returned for credit. This is a good choice for units using a smaller number of implants and where there is a need for an unusual type of size or implant.

There are two particular issues which affect the stocking system and are often overlooked:

- Stock rotation must be practised. Most implants have a five-year sterility shelf life and an expiry date has to be shown on the packaging. This means stock can be easily tracked and the ''oldest'' should be used first.
- Following the use of an implant the replacement shelf product should be ordered immediately in preparation for the next operation. This practice ensures the full choice of implant for every patient/surgeon.

Use of implants

The following points are considered best practice:

- Before surgery the patient should be informed of all complications associated with breast implants. It is advisable to have a routine procedure to achieve this without exception.
- Selection of styles and sizes of implant for a patient must allow sufficient time for the stock to be delivered.
- A consistent method of sizing should be followed utilising a combination of templates, ''sizers'', volume displacement of tissue removed and other recognised methods.
- Each implant should be used within the product data sheet recommendations.
- The surgeon should be familiar with the product instructions for use.

- A routine policy for dressing the wound and post-operative care should be practised.

Surgical equipment

The oncoplastic operating theatre must be equipped to a level which supports the performance of a full range of reconstructive procedures and provides a safe and efficient working environment for surgeons and other theatre staff.

The writing committee has found the following pieces of equipment useful in the practice of oncoplastic surgery:

Operating table and support

- An electronically adjusted operating table is highly recommended. It facilitates easier movement of the patient to a near vertical position on completion of the procedure.
- Adequate table attachments for safe positioning of patients.
- Modern equipment to reduce the risks of lengthy surgery.

Lighting and retraction

- Good theatre lighting which will allow two surgeons to operate independently.
- Additional light sources such as head lights or lighted retractors of different length and tip design.
- Appropriate retractors and forceps which may be insulated to reduce the risk of diathermy skin burns.
- Optional: endoscopic equipment with or without video transmission.

Cutting and coagulation

The extensive dissection encountered during breast reconstruction can be facilitated by the use of

- a Barron-pattern scalpel handle for making curved incisions;
- cutting diathermy equipment;
- bipolar diathermy forceps and scissors;
- ultrasonic cutting and coagulation equipment;
- tungsten carbide dissecting scissors for de-epithelialisation.

Additional equipment

- Rubber-shod artery forceps for the atraumatic clamping of the filler tubes of tissue expanders
- A set of different-sized trephines for use during breast reduction and skin-sparing mastectomy
- Ultrasound Doppler 8–12 mHz
- Microinstruments
- Magnifying loops and microscope
- Sizers for implants

Micropigmentation service (tattooing)

There is currently no recognised qualification in micropigmentation. The micropigmentation service will be delivered by an appropriately trained practitioner. The important requirements include

- A treatment area with natural lighting conditions
- Facilities for test patching in atopic individuals
- A baseline photograph
- Consent
- Local anaesthesia
- Information leaflet
- Medical tattooing equipment and dyes

Patients should be made aware that tattoos fade and may require further pigmentation procedures.

Physiotherapy following breast reconstruction

Post-operative physiotherapy plays an important role in the rehabilitation of the patient. It is imperative that physiotherapy treatment starts as early as possible and is carried out under the supervision of an experienced physiotherapist who is familiar with the surgical techniques and attendant complications.

Patient information

All patients, and if appropriate their partners must receive comprehensive information which

- realistically describes their options and anticipated possible outcomes;
- states that a reconstructed breast will not be the same as the natural breast;
- describes specific complications that may occur;
- discusses possible functional and psychological sequelae;
- includes photographic appearances of planned procedures.

In addition, all units must have written information to be given to the patient. Units should ensure that these leaflets are kept up to date (sample leaflets are available on the Cancer Backup website: www.cancerbackup.org.uk).

Health professionals should be aware of the words they use when discussing surgery and present a balanced view based on factual accuracy.

In patients whose communication in English is limited, care should be taken to ensure that the patient fully understands the implications of treatment.

Adequate space

The clinic environment should be designed in a way which provides

- an adequate waiting area for patients and their relatives;
- a relaxed environment for consultation in privacy;
- a separate space for counselling;
- easy access to refreshments.

Psychological support

Most women deal very well with the psychological demands made of them by the diagnosis and treatment of breast cancer. However, many will require additional help and support over and above that provided by their assigned breast care nurse, who should also have up to date knowledge of breast reconstruction and oncoplastic surgery.[94] [V]

Support group/''buddy'' system

Patients who have undergone oncoplastic surgery can provide beneficial support to others facing similar surgery. However, it is important to recognise this might place unexpected demands upon both women taking part. The motivation of those previous patients who are now offering their support to other women needs to be explored by the specialist nurse on a case-by-case basis, respecting the privacy of both parties. The nurse should also be in a position to provide support to women involved in a ''buddy'' system, as necessary.

Interprofessional relationships

Local

The oncoplastic service will normally be on site and will constitute a core component of the multidisciplinary team (MDT). All patients should be discussed at the MDT and treatment planned accordingly. Where reconstructive surgery is performed at a different site to that of the initial surgery, full clinicopathological details should be made available to the reconstructive team. The multiprofessional breast reconstruction team should also include relevant anaesthetic, theatre and ward staff. There should also be a psychologist, medical photographer and clerical staff for data collection and audit. There should be adequate links with managerial and clinical governance staff, as well as with the patient advisory liaison service.

Network

Oncoplastic breast services in the NHS will be provided through a managed cancer network (www.doh.gov.uk/cancer/cancernetwork). The service can use the resources of the cancer network for patient information, IT support and business planning and resources to participate in clinical trials. Units providing a comprehensive range of procedures can act as a resource for the management of more complex problems such as developmental abnormalities, revisional procedures and chest wall resection and reconstruction and should be the focus of onward referral from other units.

Commissioning

Primary care trusts will commission care of patients with breast problems but the main negotiations for cancer services is likely to take place through the cancer networks.

National professional bodies

Responsibility for defining, establishing and maintaining professional standards of oncoplastic surgery rests with the Royal Colleges representing the individual specialties which make up the MDT. They also have a responsibility for education, training and professional development in conjunction with the Association of Breast Surgery at BASO (ABS at BASO), and the British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS). The Training Interface Group in Breast Surgery is the interprofessional body with responsibility for developing the oncoplastic training initiative. This group provides advice to the Specialty Advisory Committees (SACs) in general surgery and plastic surgery. It assists with the selection and evaluation of oncoplastic training posts and is developing appropriate clinical audit.

Patient support groups

Support for patients before and after breast reconstruction should be freely available through the local breast reconstruction unit, local patient support groups and the National breast cancer care organisations (see Appendix C). There should also be a ''buddy'' system as already described (see Support group/''buddy'' system).

Independent sector

Patients undergoing breast reconstruction in the independent healthcare sector should experience standards of care equivalent to those expected in the public sector. Surgeons undertaking oncoplastic breast surgery should normally have NHS appointments and be on the specialist register for general or plastic surgery and be members of the appropriate specialist group. Surgeons who do not hold NHS appointments must be able to prove training and experience to a level of competency equivalent to that of a newly appointed NHS consultant.

Data collection, clinical governance and information

A breast unit will require information to support service planning and evaluation, performance monitoring and clinical governance.

Data collection

To ensure data are of the highest possible quality, there are some important principles of data collection that should be adhered to:

- Data should be collected once, as close to the point of service delivery or activity as possible.
- The process of patient care should drive the data collection process, with data required for all other purposes being derived from this.
- Data should be provided in an accurate and timely manner to suit the purpose for which they are required.
- Only data for which there is a defined purpose should be collected.

Information requirements

A Cancer Dataset (http://nww.nhsia.nhs.uk/cancer/pages/dataset/default.asp) has been drawn up and approved for national use. This will support the implementation of the National Cancer Plan and includes fields covering details of the patient, tumour, diagnosis, treatment and outcome.

The responsible clinician should ensure the accurate coding of operative procedures (ICD10 and OPCS4 codes should be used as an aid for identification). Necessary time and resources must be provided to carry this out. At the present time, aesthetic outcomes are not formally assessed. Nevertheless, a tool for measurement of aesthetic outcomes is required.

Clinical governance

All clinicians have a responsibility to ensure that they are maintaining a programme of continuing professional development in association with monitoring and evaluating their own performance (ref: HSC 1999/065; Clinical Governance Reporting Processes NHS E Nov 2002). The national HES dataset is being expanded to include details of the clinicians responsible for distinct interventions such as the operating surgeon.

The breast unit should ensure that there are appropriate quality assurance processes in place, incorporating regular reviews of the information available about the service provided.

It is difficult to measure, compare and interpret outcomes of evolving procedures that are performed infrequently. Sufficient numbers are needed to draw meaningful comparisons and provide an evidence base to support change in clinical practice. Supplying data to a national audit with defined standards facilitates the measurement and assessment of individual performance and supports the appropriate further development of the specialty. A national dataset will inform this process.

In addition to a programme of clinical audit, oncoplastic surgeons should be reporting incidents which compromise patient safety to the National Patient Safety Agency. Participation in other initiatives designed to reduce risk to patients is encouraged. For example, an adverse incident involving a breast prosthesis should be reported to the manufacturer (Vigilance System of the Medical Devices Directive 1993/42/EEC). A Confidential Reporting System in Surgery (CORESS), along the lines of that operated by the Civil Aviation Authority, has been established for the reporting of ''near misses''. Reports can be made, in confidence, via their website: www.coress.org.uk.

Education and training

The specialty of breast oncoplastic surgery is developing concurrently with changes in the postgraduate training of surgeons. As the specialty expands it will be important to have an education and training programme to support

- trainees wishing to enter the specialty;
- surgeons wishing to develop an interest in oncoplastic surgery and to acquire the necessary core skills;
- continuing professional development (CPD) of established oncoplastic surgeons.

A well structured, organised and managed framework for training and education is essential to assist the Postgraduate Medical Education and Training Board (PMETB) in reinforcing and maintaining professional standards. To do so, the competencies and skills required, together with an approach to training that recognises the need to consider the training experience from the perspective of trainer and trainee must be well documented and validated.

This section of the document focuses on the educational and training needs of the oncoplastic surgeon. Other members of the team will require education and training specific to their discipline.

Future training will be competency-based and defined by specialty curricula. Training resources will have to be accommodated alongside the service demands, matching the needs of surgeons to the programmes. The time for education and training is becoming shorter at all levels. It is important to ensure that sufficient clinical experience is gained and programmes are quality assured.

Definition of a breast reconstruction unit

1. A Breast Reconstruction Unit is defined as a core component of the MDT with sufficient experience to offer patients access to the full range of procedures encompassed by oncoplastic breast surgery. Providers of

oncoplastic education and training may require the trainee to attend one or more units as part of their education.
2. For training purposes, a Breast Reconstruction Unit will be classified according to the level of expertise and range of procedures available within the unit.
3. The status of the unit will depend on the level of service provided as defined by the caseload, case mix, timing of reconstruction, personnel, skills and experience and their capacity to meet the trainees' needs.

A *Level I Oncoplastic Training Unit* will provide training to deliver a core oncoplastic service regardless of the clinical setting. Such a unit is likely to be of relevance to the training of a wide range of professionals, including all the surgeons identified above. This will imply:

- A caseload of at least 25 major reconstructive procedures per annum as the minimum requirement for a Level 1 oncoplastic training Unit. These must be performed by a surgeon(s) participating in a programme of CPD in oncoplastic surgery.
- Exposure to a range of the core oncoplastic procedures such as implants, expanders and latissimus dorsi myocutaneous flaps.
- Experience of immediate and delayed reconstruction.
- At least one surgeon trained in breast reconstruction, supported by an appropriately constructed multidisciplinary team working with theatre and ward personnel, all with adequate levels of experience.
- Formal lines of communication with a plastic surgery unit or Level II Oncoplastic Training unit who will provide the full range of more complex reconstructive procedures.

A *Level II Oncoplastic Training Unit* will provide training necessary to deliver a comprehensive oncoplastic service which includes all aspects of breast oncology and plastic reconstructive surgery. In addition to the core training provided by the Level I unit, key aspects of a Level II Training Unit will imply

- A caseload of more than 50 reconstructive procedures per annum.
- A comprehensive case mix, including autologous flaps, breast-conserving reconstruction using volume replacement and volume displacement techniques, correction of asymmetry and salvage surgery.
- At least two surgeons trained to an advanced level in breast reconstruction, one of whom must be a plastic surgeon with a special interest in breast reconstruction.
- Full supporting services, including dedicated high dependency beds, vascular imaging facilities, access to microvascular surgery, a comprehensive implant and expander resource and equipment for nipple–areola pigmentation although the latter may also be available in a Level I unit.

Essential skills in oncoplastic breast surgery

1. All surgeons performing oncoplastic breast surgery should acquire core skills which will enable them to provide a Level I oncoplastic service, as previously defined.
2. The curricula for breast and plastic surgeons laid down by the Specialty Advisory Committees (SACs) of the parent specialties define a skill base which includes knowledge-based, teamworking, communication, diagnostic and technical skills (Appendix A).
3. The knowledge-base of the oncoplastic surgeon or group of surgeons should include a detailed understanding of:
   - the basic sciences relevant to the prevention, diagnosis, treatment and clinical research of breast disease;
   - planning, monitoring and evaluation of services for breast cancer;
   - medical practice within an ethical framework.
4. Teamworking and communication skills should be reinforced by the opportunity to experience and observe cohesive integrated teams in action. This implies:
   - Attendance at the multidisciplinary meeting.
   - Joint consultations with other specialists.
   - Joint operating lists, involving breast, plastic and oncoplastic surgeons.
   - Exposure to different leadership and managerial styles.
   - Opportunity to participate in clinical research.
5. The diagnostic and technical skill base of the oncoplastic trainee will include competency in core procedures including:
   - the investigation and management of breast abnormalities;
   - the investigation and management of the axilla;
   - a range of immediate and delayed reconstructive techniques (see Selection of breast reconstruction techniques);
   - the management of complications associated with the above procedures.

Acquiring the skills

Workplace training can equip the oncoplastic surgeon with the necessary skills. These can be supplemented by drawing on a variety of other resources, including comprehensive texts, landmark publications, courses and workshops.

Workplace training

The majority of oncoplastic training will be carried out in the workplace, and a number of training opportunities have been developed including

- Twelve-month posts in oncoplastic breast surgery for higher surgical trainees in England with National Training Numbers (NTN) during the flexible year, prior to gaining the CCT. These are centrally funded posts developed by the Specialist Advisory Committee (SAC) in General Surgery in collaboration with the SAC in Plastic Surgery (see Frameworks for postgraduate education and training). Comparable arrangements have been established outside this framework.
- Interactive demonstrations of oncoplastic surgery providing trainees and consultants with direct experience of oncoplastic surgery.
- Opportunities for workplace training including clinical attachments to specialist oncoplastic units in the UK, mainland Europe and the USA.

Comprehensive texts and landmark publications

Several high quality texts are available which cover all aspects of reconstructive and corrective breast surgery (see Appendix A). Access to key publications in peer reviewed journals is necessary to supplement this knowledge base, and enable the oncoplastic surgeon to maintain contemporary practice.

Courses and workshops

All Royal Colleges provide a variety of courses. The Royal College of Surgeons of England provides a portfolio of educational courses for higher surgical trainees and consultants with an interest in oncoplastic breast surgery. Other courses in breast reconstruction are held in the UK, mainland Europe, the USA and Australasia (see Appendix A).

Validation of training and audit of outcomes

Oncoplastic surgery is an evolving specialty with skills and mechanisms for validation of training that are being developed. Currently, validation of Higher Surgical Trainees (HSTs) training is carried out by the parent SACs and Regional Training Committees. These arrangements are being reviewed.

Frameworks for postgraduate education and training

Opportunities for education and training in oncoplastic surgery are underpinned by interprofessional relations which have been established at local, regional, national and international levels.

1. The responsibility for the surgical education and training of oncoplastic trainees lies with their educational supervisor. An essential part of the training programme is attendance at the multidisciplinary meeting.
2. Oncoplastic training is unevenly distributed in the UK. Regional programmes for education and training are coordinated by the Regional Specialty Training Committees (STCs), which report to the Postgraduate Dean. They are responsible for the placement of trainees in posts. These posts must be able to provide a level of specialty training that meets the requirements of the SAC curriculum for general and plastic surgeons with a specialty interest in oncoplastic surgery. Interdeanery transfers may be necessary to ensure adequate specialty training until the relevant STCs develop local rotations to meet the trainee's needs.
3. Nationally, the Parent Associations of BAPRAS and ABS at BASO develop programmes and are setting standards for training and education in oncoplastic surgery in conjunction with the Surgical Royal Colleges.
4. International interprofessional programmes in breast reconstruction have been developed by the European School of Oncology (ESO) (see Appendix A).

Conflicts of interest

The writing group was appointed by the Association of Breast Surgery at BASO, the British Association of Plastic, Reconstructive and Aesthetic Surgeons and the Interface Group. All members of the writing group declare no conflict of interest.

Role of funding source

The guidelines were partly sponsored by Allergan Ltd and Mentor Medical Systems. Other funding came from the Association of Breast Surgery at BASO. Both companies manufacture breast implants and were invited to be observers on the advisory group. Both companies have previously been involved in the support of educational courses run by the Royal College of Surgeons of England. Neither company's products are exclusively endorsed in these guidelines.

Appendix A

Comprehensive texts

1. Bostwick J, editor. *Plastic and reconstructive breast surgery*. St. Louis, Missouri 63146: Quality Medical Publishing, Inc.; 2001.
2. Spear SL, editor. Surgery of the breast. *Principles and art*. Philadelphia, Philadelphia 19106: Lippincott-Raven; 1998.
3. Bohmert H, Gabka C, editors. *Plastic and reconstructive surgery of the breast*. New York 10016, New York: Thieme Medical Publishers; 1997.

Education technology

The following teaching videos are available from the Raven Department of Education, Royal College of Surgeons of England.

- Conversations in anatomy – the breast.
- Inferior pedicle breast reduction and mastopexy.
- Step-by-step guide for a latissimus dorsi miniflap breast reconstruction.
- Step-by-step guide to skin-sparing mastectomy and immediate reconstruction.

Dissection guides

The following dissection guides have been produced by the Raven Department of Education of the Royal College of Surgeons of England and are available to course participants.

- Subpectoral reconstruction
- Latissimus dorsi reconstruction
- Latissimus dorsi miniflap reconstruction
- TRAM-flap reconstruction
- Inferior pedicle breast reduction

Courses – London-based courses (Raven Department of Education, Royal College of Surgeons of England, 35–43 Lincolns Inn Fields, London WC2A 3PE, UK)

1. ABS at BASO/RCS England Intermediate Distance Learning Course.
2. ABS at BASO/RCS England Advanced Breast Disease Management Course.
3. ABS at BASO/BAPRAS/RCS England Fundamental Breast Reconstruction Course.
4. ABS at BASO/BAPRAS/RCS England Advanced Breast Reconstruction Course.
5. ABS at BASO/BAPRAS/RCS England Master classes in Breast Reconstruction.

Courses – regionally based courses

1. ABS at BASO/Glasgow Royal Infirmary Trainees Meeting, Glasgow.
2. Canniesburn Expander/Implant Course, Canniesburn Unit, Glasgow, Scotland.
3. ABS at BASO/BAPRAS/RCS England – Winchester/Jersey Masterclass in Oncoplastic Breast Surgery.
4. Canniesburn Flap Course, Canniesburn Unit, Glasgow, Scotland.
5. Canniesburn Microvascular Anastomosis Course, Canniesburn Unit, Glasgow, Scotland.
6. Nipple Areola Tattooing Course, The Belmore Centre, Ranch House, Lower Road, Stoke Mandeville, Bucks, HP21 9DR. enquiries@belmorecentre.co.uk

European organisations

1. European School of Oncology (ESO). Viale Beatrice d'Este, 37-20122 Milan, Italy.
2. European Institute of Oncology (EIO). Via Ripamonti, 435, 20141 Milan, Italy.
3. The European Society of Mastology (EUSOMA). Corso Italia 16, 20122 Milan, Italy.

Curriculum documents

1. The Training of a General Surgeon with an interest in breast disease. *The European Journal of Surgical Oncology* 1996;**22**(Suppl. A):2–4.
2. The requirements for Higher Surgical Training in Plastic and General Surgery are available on the JCHST website: www.jchst.org.

Appendix B

Surgical equipment

Individual members of the committee have found the following equipment to be helpful. This list should not be taken as either comprehensive or as an endorsement of what is listed.

Infiltration

- Multi-Ad™ fluid dispensing system. B Braun Medical Inc., Bethlehem, PA 18018, USA.
- Steriseal™ needle 1.2 × 1.50 mm. Maersk Medical Ltd, Redditch B98 9NL, UK.
- Contour Genesis ™ Infiltrator. Mentor Medical Systems, Minneapolis MN55411, USA.

Lighting and retraction

- Xenon-powered headlight. Welch Allyn Inc., Skaneateles Falls, NY, USA.
- Diamond-View™ retractor system. Snowden Pencer, GA 30084, USA.
- Tebbetts™ double-ended breast retractor, Snowden Pencer, GA 30084, USA.
- Maxwell flap retractor, Snowden Pencer, GA 30084, USA.

Cutting and coagulation

- Argon-enhanced electrosurgery. Valleylab Inc., Boulder, CO 80301-3299, USA.
- Power Star™ scissors. Ethicon endosurgery, D22851 Nordestedt, Germany.
- Harmonic scalpel™. Ultracision Inc., Smithfield, RI 02917, USA.
- Metzenbaum Supercut™. Tungsten Carbide scissors, Snowden Pencer, GA 30084, USA.

Appendix C. Useful addresses

Websites

- *CancerBACKUP* – www.cancerbackup.org.uk/Treatments/Surgery/Breastreconstruction
- *Breast Cancer Care* – www.breastcancercare.org.uk
- *Breast Cancer Campaign* – www.bcc-uk.org
- *Breakthrough Breast Cancer* – www.breakthrough.org.uk
- *Cancer Help*, provided by cancer research UK – www.cancerhelp.org.uk
- *Cancerlink* – www.cancerlink.org
- *Royal Marsden Hospital* – www.marsden.org/patientinfo/booklets/breast_reconstruction/breast.asp

Helplines

- *CancerBACKUP* – freephone 0800 181 199 or 0808 800 1234.
- *Breast Cancer Care* – freephone 0808 800 6000 (Monday–Friday 10.00 am–5.00 pm).
- *Cancerlink* – freephone 0800 132905.

Addresses

Breast Cancer Care, Kiln House, 210 New Kings Road, London, SW6 4NZ, UK. Tel.: +44 20 7384 2984; fax: +44 20 7384 3387.

Breast Cancer Care (Scotland), 46 Gordon Street, Glasgow, G1 3PU, UK. Tel.: +141 221 2244; fax: +141 221 9499.

Appendix D

Physiotherapy following breast reconstruction

Breast reconstruction involves complex surgery, and affects not only the shoulder joint and function of the arm, but also the shoulder girdle, thoracic spine, or abdominal musculature depending on which procedure is used. Regaining shoulder mobility and full function of the arm, whilst simultaneously minimising donor site morbidity are essential components of the management of breast reconstruction patients. Post-operative physiotherapy plays an important role in the rehabilitation of the patient, and it is imperative that physiotherapy treatment, starting as early as possible, is carried out under the supervision of a specialist physiotherapist who is familiar with the surgical techniques and attendant complications, and experienced in treating such patients.

Physiotherapy guidelines following reconstruction with an implant/expander

- The implant is usually placed sub-muscularly, in a pocket created underneath the pectoralis major and therefore movements that involve using or stretching the pectoralis major should be avoided for 2–3 weeks.
- For the first 2–3 weeks, short lever shoulder rotation and pendular exercises are encouraged, avoiding abduction above approximately 90°.
- During these first 3 weeks, the patient can use her arm normally within a pain free range but is discouraged from doing any lifting, abduction above shoulder height, or shoulder extension.
- Inflation is usually started at approximately 3 weeks, and from this point, the arm can be moved and used normally since the inflation process also stretches the muscle.
- Patients are generally advised not to do anything with the arm that feels very tight or painfully stretching, but to increase use and allow movement to return gradually.
- The process of tissue expansion can stretch and thin the pectoral muscle (Gur 1998, Level III) and therefore sudden heavy lifting or heavy resisted use of the arm is discouraged. A gradual return to normal activities and use is encouraged to improve strength in the affected muscle.
- Driving can be resumed at 3–4 weeks, as long as the patient is confident of being able to handle the car in an emergency situation.

Physiotherapy guidelines for reconstruction using latissimus dorsi flap

- The latissimus dorsi is raised off the back, tunnelled under the axilla, in most cases still attached to its insertion on the humerus, and sutured to the pectoralis major with an implant, if used, placed underneath these two muscles or under the latissimus dorsi only.
- The latissimus dorsi may still be innervated, and so any movement/activity that causes the muscle to contract, or stretches either the latissimus dorsi or the pectoralis major should be avoided for approximately 4 weeks until the wounds have healed.

First 4 weeks

- Short lever rotation, flexion and abduction to approximately 90°, pendular exercises, and scapular protraction and retraction (arms by sides) are commenced from day 1 post-operatively and continued for the first 4 weeks, gradually increasing range of movement but avoiding any abduction/elevation above approximately 90° or shoulder extension.
- The patient is encouraged to use her arm normally for light activities including hair brushing, etc. whilst avoiding any activity that causes the latissimus to contract e.g.: pushing up off the bed with the affected arm.

After 4 weeks

- Normal use of the arm is encouraged except heavy lifting or resisted shoulder extension/adduction, which can usually be resumed by 12 weeks.

- Active assisted shoulder flexion in supine, and active abduction exercises (wall walking) are commenced if there are restrictions in movement.
- Scapular protraction and retraction exercises are commenced to keep the donor scar mobile and prevent it from adhering: scapular protraction with bilateral horizontal shoulder flexion combined with deep inspiration (this stretches the scar around the serratus anterior/thoracic area), and scapular protraction in supine (fingertips towards ceiling).
- Abduction with lateral rotation (hands behind head) is encouraged as this movement is often tight and restricted. This is particularly important if the patient is to have radiotherapy to the axilla.
- Once full active abduction is achieved, stretches into abduction combined with side flexion of the trunk away from the reconstructed side are encouraged to stretch the donor site over the lateral chest wall.
- Driving can be resumed at 4 weeks, assuming the patient is confident at handling the car, and with left sided reconstructions, can manage the gear lever and handbrake.
- Once the donor site wound has healed, firm massage of the skin over the donor site and lateral chest wall is encouraged to prevent the scar from adhering.
- It can take several months for the latissimus dorsi to feel that it is part of the breast and not on the back – sensations of the breast moving during certain activities that cause the latissimus dorsi to contract are not uncommon which is why vigorous use of the arm is discouraged until all the wounds have healed.

Note

1. The 4-week time-scale is a general guideline. If:
   - the patient is being very protective of the affected arm;
   - the shoulder joint is becoming very stiff;
   - the patient has undergone recent axillary surgery (i.e. lumpectomy and axillary clearance shortly before proceeding to completion of mastectomy);
   - the patient needs to start radiotherapy very soon after surgery.

Then range of motion exercises are commenced sooner and the patient is advised to increase active use of the affected arm. As with all situations, clinical judgement is required on an individual case basis.

2. The size and extent of the flap (i.e. standard or extended), seroma formation, and size/shape of the patient are all factors that can affect shoulder and scapular mobility.
3. If there is a wound infection, or the donor wound dehisces, or in the presence of complicated wounds, range of motion exercises are progressed appropriately in conjunction with the surgeon.
4. Delayed wound healing at the donor site can cause the scar to adhere to the underlying tissues, restricting scapular mobility and shoulder range of movement. Thoracic expansion with scapular protraction helps keep the donor area mobile whilst the wounds heal, and once healed, scapular mobilisations, firm tissue massage, and protraction exercises in supine and forward lean sitting can be used to regain range of movement and tissue mobility (Clough 2002, Level III).

Physiotherapy guidelines for reconstruction using TRAM/DIEP flaps

First 6 weeks

- Short lever rotation and flexion are commenced on the first post-operative day, plus standard respiratory care.
- If the vascular anastomosis has been done in the axilla, the shoulder should not be abducted above 90° for the first 5–7 days to avoid stretching the anastomosis; if the internal mammary vessels are used, shoulder extension and shoulder girdle retraction should be avoided but the patient can abduct/flex the shoulder within a pain free range.
- If the viability of the flap is in question, confirm how much shoulder movement the patient can be allowed to do with the surgeon.
- After the first 5 days or so, once the vascularity of the flap is well established, progressive active arm exercises are commenced, including active assisted flexion, abduction and increasing short lever rotation.
- Pelvic tilting is commenced within the first 2–3 days, and continued for at least 6 weeks post-operatively to ease/prevent back pain, encourage scar and lumbar spine mobility, and encourage sub-maximal contraction of the rectus abdominis muscle.
- Leg rolling side to side with knees together in crook lying can also be started within the first few days to improve mobility.

From 4–6 weeks

Abdominal hollowing can be started from approximately 4 weeks and should be encouraged in crook lying initially and then four point kneeling (once this position is comfortable) to develop good control of transversus abdominis and provide muscular support for the abdominal wall.

- Once control of the movement has been achieved an abdominal hollowing contraction should be encouraged during lifting and functional activities.

- Curl-ups and oblique curl-ups can be commenced at 6–8 weeks, once a good abdominal hollowing contraction can be maintained.
- Abdominal exercises can then be progressed on an individual basis; Pilates exercises are excellent.
- Once the abdominal wound is healed, gentle stretching of the abdominal wall can be commenced, to regain normal posture and prevent adhesions. The number of pillows required under the patient's knees in bed at night is gradually reduced, progressing to lying flat, lying supine over a pillow and eventually lying prone propped up on the elbows as appropriate.
- Firm massage with moisturiser over the abdominal skin and scar is encouraged once the wounds are healed to keep the skin supple.
- Lifting or vacuuming should be avoided for at least 6 weeks, longer if there is a wound infection or delayed wound healing.
- In general no driving for 4–6 weeks, depending on which arm is affected, the patient's general progress, and ability to handle the car.

Note

The type and speed of progression of abdominal exercises, the time-scales for resuming normal activities and the long-term functional outcome following surgery will depend on which variant of abdominal tissue transfer has been used – pedicled TRAM, free TRAM, DIEP or SIEA – and therefore the amount of rectus muscle and anterior rectus sheath that has been sacrificed with the flap. There is increasing evidence to demonstrate that apart from the SIEA flap (which can only be used in a small percentage of women due to vessel size), the DIEP flap causes the minimal impact on abdominal muscle strength and function (Futter 2000, Level IV, 2002, Level IV). It is therefore important to know which procedure the patient has undergone so that a rehab programme of abdominal exercises can be planned appropriately.

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Appendix E

Assessment of flaps: explanation and example of a flap chart

Monitoring flaps is an important part of the nurse's role in the post-operative period. This involves checking the area every 15 min reducing to every 4 h over 4 days post-operatively. Monitoring of flaps is difficult to do accurately without experience. The ideal flap chart should be able to deliver objective information that any nurse can perform and interpret. An adapted chart is attached.

The flap is assessed using the following factors:

1. *Colour* – The graded colour strip may be compared to the flap and the corresponding colour charted on the graph. Paleness may indicate arterial occlusion and or a cyanotic colour indicates venous occlusion or congestion.
2. *Temperature* – A flap should be of similar temperature to the surrounding untraumatised skin. This is best judged using the back of the fingers of one hand. One finger on the flap and one on the surrounding skin. The measuring of temperature is not used in the charting of oral flaps.
3. *Capillary refill* – This is assessed by applying gentle finger pressure to the flap. A 3-s refill may be considered ''normal''. No blanch may indicate a congested flap. A quick refill of less than 3 s indicates a good arterial flow. No refill signifies an arterial occlusion.
4. *Texture* – A flap should be soft to touch. Any oedema, tension or haematoma may create a hard swollen flap. A spongy flap may be due to an arterial occlusion or kinking of the flap.

In conjunction with these four observations, it is important to consider several other factors, which may influence flap survival.

- Flap type: Is it a free or pedicled flap? From where does the blood supply arise?
- Donor site: The colour of the flap deprivation area will influence flap colour. The colour of the donor site should also be taken into account.
- Light source: It is important to be consistent, especially at night. The same anglepoise light or torch should shine from a constant distance from the flap.

FLAP / REPLANTATION CHART

PTS. NAME WARD HOSP No.

CONSULTANT NAMED NURSE

DATE														
TIME														
INITIAL														
COLOUR														
BLUE **[V]**														
REDDISH PURPLE														
FLORID RED														
DEEP PINK														
PINK [NORMAL]														
PALE PINK														
MOTTLED														
WHITE**[A]**														
TEMP.														
HOT														
WARM														
COOL														
COLD														
CAP.REFILL														
IMMEDIATE <1 SECOND														
1-3 SECS.														
> 3 SECS.														
TEXTURE														
HARD														
FIRM														
SOFT														
EMPTY														
OTHER														
SEEN BY DOCTOR														
BUPIV. INF.														
DEXTRAN 40														
LEECH ON/OFF														
SENSATION/ DOPPLER														
NEEDLE PRICK														
F = FAST														
N =NORMAL														
S = SLOW														
O = NONE														

Appendix F. Levels of evidence

The evidence cited in the guidelines has been classified as accurately as possible into 5 levels:

- *Level I evidence* is based on randomised, controlled trials (or meta-analysis of such trials) of adequate size to ensure a low risk of incorporating false-positive or false-negative results.
- *Level II evidence* is based on randomised, controlled trials that are too small to provide level I evidence. These may show either positive trends that are not statistically significant or no trends and are associated with a high risk of false-negative results.
- *Level III evidence* is based on nonrandomized, controlled or cohort studies, case series, case-controlled studies or cross-sectional studies.
- *Level IV evidence* is based on the opinion of respected authorities or that of expert committees as indicated in published consensus conferences or guidelines.
- *Level V evidence* expresses the opinion of those individuals who have written and reviewed these guidelines, based on their experience, knowledge of the relevant literature and discussion with their peers.

These 5 levels of evidence do not directly describe the quality or credibility of evidence. Rather, they indicate the nature of the evidence being used. In general, a randomised, controlled trial has the greatest credibility (level I); however, it may have defects that diminish its value, and these should be noted. Evidence that is based on too few observations to give a statistically significant result is classified as level II. In general, level III studies carry less credibility than level I or II studies, but credibility is increased when consistent results are obtained from several level III studies carried out at different times and in different places.

Decisions must often be made in the absence of published evidence. In these situations it is necessary to use the opinion of experts based on their knowledge and clinical experience. All such evidence is classified as ''opinion'' (levels IV and V). Distinction is made between the published opinion of authorities (level IV) and the opinion of those who have contributed to these guidelines (level V). However, it should be noted that by the time level V evidence has gone through the exhaustive consensus-building process used in the preparation of these guidelines, it has achieved a level of credibility that is at least equivalent to level IV evidence.

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