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## Breast reconstruction

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### Introduction

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With the increasing utilisation of neoadjuvant chemotherapy and oncoplastic techniques, more patients who would have required mastectomy are eligible for breast conservation. For complex psychosocial reasons there is a continual growth in the number of patients undergoing contralateral risk-reducing mastectomy, and overall, despite significant geographic variation, rates of breast reconstruction following mastectomy continue to rise.<sup>1-3</sup> Mastectomy for breast cancer can lead to negative psychological effects on the patient, and breast reconstruction, whether immediate or delayed, can provide significant psychosocial benefits.<sup>3,4</sup>

Surgery for breast cancer is not finished until the reconstruction has been completed in those patients who choose to have it. Even the most sophisticated breast reconstruction, however, will never fully replicate the breast that has been lost in feel, movement and erogenous sensation, although some spontaneous sensory recovery may occur. It is important that the patient understands these limitations at the outset or they will always be disappointed by the outcome. The goal of breast reconstruction is to produce a breast mound that satisfies the patient's wishes and matches the contralateral breast. Improvement of the preoperative breast aesthetic is sometimes possible.

Breast reconstruction may be either autologous, non-autologous, or a combination of the two, with the use of symmetrising mastopexy, reduction or augmentation surgery if necessary. Women must be fully informed of all available options for

breast reconstruction at the time of planning initial surgical treatment so that they can make informed decisions, even if it is their personal preference to have a delayed reconstruction or no reconstruction at all.<sup>3,5</sup> The decision regarding the timing and technique of breast reconstruction should be made by the patient and a multidisciplinary breast cancer team, which should include reconstructive surgeons who are able to provide the full range of commonly used reconstructive procedures.

### Timing

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The principal aim of breast cancer surgery is to provide safe and successful oncological treatment. The decision for delayed or immediate breast reconstruction and the type of reconstruction offered may be affected by the anticipated need for adjuvant therapy or previous breast radiotherapy.<sup>6</sup> The increasing indications for postmastectomy radiotherapy and for irradiation of the internal mammary lymph node chain provide challenges to breast reconstructive algorithms.<sup>7</sup>

### Immediate breast reconstruction

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#### Advantages

The main advantage of immediate breast reconstruction is that the patient does not have to spend any time without a breast mound. Skin-sparing and nipple-sparing mastectomy techniques are oncologically safe in appropriately selected patients.<sup>8,9</sup> These techniques allow preservation of

the native breast skin envelope and inframammary fold and therefore the reconstruction assumes a more natural shape and appearance when the breast volume is restored. The mastectomy skin flaps are pliable and unaffected by soft-tissue contracture and scar, and have not usually suffered the effects of radiotherapy. The need for contralateral symmetrisation surgery may also be reduced. A variety of incisions are available for nipple-sparing mastectomy, although incisions on the breast boundary are associated with reduced risk of nipple areola complex necrosis. Nipple-sparing mastectomy allows for total preservation of the breast skin envelope and is associated with high patient satisfaction in patients for whom it is indicated.<sup>10</sup>

### Disadvantages

The disadvantages of immediate reconstruction are the limited time for decision-making by the patient due to the need to perform the oncological surgery in a timely manner, increased operating time, and the difficulties of coordinating two surgical teams where different surgeons are required to perform the mastectomy and reconstruction. Immediate breast reconstruction does not compromise adjuvant treatment overall, although there is a potential in individual patients for complications to result in a delay in starting adjuvant treatment.<sup>11</sup> In patients receiving contralateral prophylactic mastectomy and immediate reconstruction, effort should be made to perform this synchronously, although the patient should be aware of the potential impact on the timing of adjuvant therapy where required.<sup>12</sup>

The current indications for postmastectomy radiotherapy lead many patients to receive radiotherapy as part of their breast cancer treatment. The possibility of radiotherapy should be anticipated before proceeding with immediate breast reconstruction. All radiotherapy regimens have detrimental effects on breast reconstructions; however, there is great heterogeneity in planning and delivery, with some regimens leading to more soft tissue fibrosis and volume loss than others; autologous reconstructions though tend to be more resistant to the effects of radiotherapy than implant-based procedures, independent of timing.<sup>13,14</sup> Delayed-immediate reconstruction is increasingly being utilised in some but not all centres to reconcile the competing interests of the reconstruction and oncological requirements, combining the advantages of the skin-sparing mastectomy available in immediate reconstruction with the avoidance of irradiating the definitive reconstruction. A skin-sparing mastectomy and immediate reconstruction with a tissue expander is performed. Once the final pathology is available, patients who do not require adjuvant radiotherapy proceed to immediate breast reconstruction. Those

who require radiotherapy have their expander partially deflated prior to radiotherapy to allow optimal delivery of the radiotherapy, following which the expander is serially re-expanded within a few weeks of completion of radiotherapy to prevent contraction of the skin envelope whilst awaiting delayed reconstruction.<sup>15</sup> Although acellular collagen matrix (ACM) may confer a protective effect on the tissue expander during radiotherapy and maintains pliability of the mastectomy skin flap through the re-expansion process,<sup>16,17</sup> a meta-analysis showed consistent radiotherapy effects with a significant increase in the rate of most post-reconstruction complications.<sup>18</sup>

It is well established that immediate breast reconstruction does not adversely affect breast cancer outcome.<sup>19</sup> Breast reconstruction may be indicated in advanced disease to control locoregional disease and improve quality of remaining life, and even following systemic therapy for inflammatory breast cancer without compromising oncological outcome.<sup>20</sup>

Where the viability of parts of the mastectomy skin flap is uncertain, perfusion imaging can be used to determine whether debridement should be performed.<sup>21</sup> For prosthetic reconstruction, there is the option to defer the reconstruction until the mastectomy skin flap necrosis has declared itself over the subsequent few days. In the case of autologous reconstruction, it may be prudent not to de-epithelialise the part of the flap skin paddle under the questionable part of the mastectomy skin flap until any area of necrosis has manifested itself.

## Delayed breast reconstruction

### Advantages

Delayed breast reconstruction allows the patient time for decision-making, psychological adjustment following their breast cancer diagnosis and mastectomy, and allows the full pathology to be available, and therefore the decision on adjuvant radiotherapy, to be made prior to reconstructive surgery. It avoids any potential delay of adjuvant treatment and avoids any detrimental effects of adjuvant therapy on the reconstruction. In addition, the mastectomy skin flaps can be allowed to heal if necessary and any skin damaged by radiotherapy can be excised at the time of the reconstruction.

### Disadvantages

The main disadvantage is that the mastectomy skin envelope cannot be preserved, leading to an inferior cosmetic outcome. Autologous reconstruction is typically indicated, and a much larger skin paddle is required. In addition, a second operation and episode of hospitalisation is required and treatment

**Box 13.1** • Advantages and disadvantages of immediate and delayed breast reconstruction

#### Advantages of immediate breast reconstruction

- Potential for a single operation and one period of hospitalisation
- Maximum preservation of breast skin envelope
- Preservation of the inframammary fold
- Good-quality skin flaps
- Better cosmetic results than for delayed reconstruction
- Avoids negative psychosocial effects of mastectomy whilst awaiting reconstruction
- Reduced need for symmetrising surgery to the contralateral breast
- Lower costs than delayed reconstruction

#### Disadvantages of immediate reconstruction

- Prolonged operating time for decision-making by patient
- Increased single operation duration
- Difficulties of coordinating two surgical teams when required
- Potential in individual patients for complications to result in delay to adjuvant treatment

#### Advantages of delayed breast reconstruction

- Allows unlimited time for decision-making by the patient
- Avoids any potential delay of adjuvant treatment
- Avoids detrimental effects of radiotherapy or chemotherapy on the reconstruction
- Good patient satisfaction as patient comparing with no breast rather than normal breast

#### Disadvantages of delayed breast reconstruction

- Requires replacement of a larger amount of breast skin
- Mastectomy flaps may be thin, scarred, contracted or irradiated
- Mastectomy scar may be poorly positioned
- May result in a less aesthetically pleasing outcome
- Requires separate operation, episode of hospitalisation and recovery period
- Increased treatment cost compared with immediate breast reconstruction

costs are increased compared with immediate reconstruction (see [Box 13.1](#)).<sup>22</sup>

## Contraindications

Contraindications to breast reconstruction include serious medical comorbidities, unresectable local chest wall disease, or rapidly progressive, uncontrollable metastatic disease. Active cigarette smoking and obesity are independent risk factors for surgical site complications and considered to be relative contraindications.<sup>23</sup>

Studies have shown that even a short period of abstinence from smoking reduces complications so many surgeons advocate complete abstinence from cigarette smoking for at least 6 weeks prior to skin- or nipple-sparing mastectomy and reconstruction, regardless of technique, to reduce the risk of mastectomy skin flap necrosis and wound-related complications. There is an incremental increase in complication rate with increasing classes of obesity, in particular where body mass index (BMI) is  $\geq 35$ . In autologous reconstruction, the majority of these complications relate to delayed wound healing; however, for implant-based reconstructions wound healing problems may result in loss of reconstruction.<sup>23</sup>

## Techniques

Breast reconstruction involves the restoration of breast volume and may involve the replacement of breast skin and nipple-areola complex. Surgical options for reconstruction include the use of breast implants, tissue expanders or expander-implants, and the use of autologous tissue with or without an implant. The most commonly used surgical techniques are tissue expander-implant reconstruction, direct-to-implant breast reconstruction, latissimus dorsi musculocutaneous flap with or without implant, or the use of a free lower abdominal tissue flap or a free thigh-based flap.

Implant-based techniques have the shortest operating time, inpatient stay and fastest recovery, but these initial advantages are offset by the finite lifespan of the prosthesis requiring future exchange, and the deterioration of aesthetic appearance with time.<sup>24</sup> The reconstructed breast is tethered in position with its shape defined by that of the implant. The larger or more ptotic the opposite breast is, the harder it will be to obtain symmetry unless contralateral augmentation or mastopexy is performed. The technique is best indicated for immediate reconstruction following skin- or nipple-sparing mastectomy in patients with small to moderate-sized breasts with minimal ptosis, where radiotherapy is not a factor, in the previously augmented patient, and where bilateral mastectomy is required.

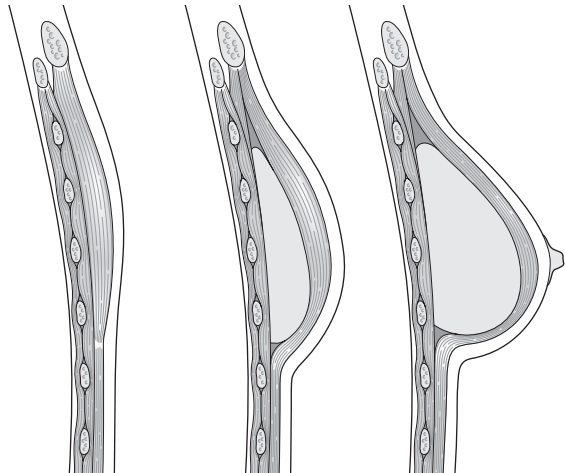
The aesthetics of autologous reconstruction and patient satisfaction with their reconstruction improve with time, and may be superior to implant-based reconstruction with more natural appearance, feel and durability.<sup>24</sup> In addition, autologous tissue can better withstand radiotherapy than prosthetic breast reconstruction.<sup>13</sup> The technique is best indicated in patients with moderate to large breast size with ptosis, with suitable donor sites that are acceptable to the patient, and where radiotherapy has been given or is planned.

✓ The timing and type of reconstruction need to be individualised to the need for adjuvant treatment, risk factors for surgery, breast size, body habitus, skin quality and thickness, availability and quality of flap donor sites, the patient's general health and smoking habits, and the contralateral breast. Patients must be fully informed on the reconstructive options available and their limitations so that they can make informed decisions regarding their care, and the reconstructive surgical team must be able to provide the full range of commonly used reconstructive options.<sup>3,5</sup>

## Non-autologous reconstruction

Non-autologous reconstruction may be achieved either with tissue-expander to implant, direct-to-implant, or expander-implant reconstruction. There is a continuously increasing catalogue of available prosthetic devices and biological (ACMs) and artificial matrix slings from different manufacturers leading to refinement of outcomes. Tissue-expander placement at the time of mastectomy is typically behind the pectoralis muscle, with total expander coverage achieved by a submuscular approach, under the serratus fascia, or with the use of ACM. The use of ACM has resulted in the possibility of prepectoral tissue expander placement, reducing morbidity and avoiding the animation deformity on contraction of the pectoralis major muscle.<sup>25</sup> Serial expansion is performed by repeated injections of saline into an inflatable silicone expander (Fig. 13.1). This may either be followed by replacement with a definitive implant once expansion is complete, or in the case of a permanent expandable breast implant that consists of a silicone outer lumen and an expandable saline inner lumen, only the filling port may need to be removed if it is not integrated into the device.

**Figure 13.1** • Illustration of technique of delayed breast reconstruction with submuscular tissue expander.  
Courtesy of Eva M. Weiler-Mithoff.



**Figure 13.2** • Delayed breast reconstruction by tissue expansion.

Courtesy of Eva M. Weiler-Mithoff.

Direct-to-implant breast reconstruction in conjunction with ACM is increasingly utilised to provide one-stage reconstruction with predictable outcomes, in particular when combined with nipple-sparing mastectomy.<sup>26</sup>

The outcomes of the technique are dependent on careful patient and implant selection (Fig. 13.2). The technique is simpler than autologous techniques, and excellent cosmetic outcomes can be achieved. The use of ACM can allow much improved inframammary fold definition.<sup>27</sup>

It remains difficult, however, to create ptosis with this technique (Fig. 13.3).

### Indications

This technique is most suitable for patients with small or moderate-sized breasts with minimal ptosis, when performing bilateral reconstruction, or for women who are happy to accept a mastopexy or augmentation procedure on the opposite breast. It is ideal for patients who want the shortest hospitalisation and recovery period, to avoid additional donor sites and scars, and



**Figure 13.3** • Bilateral skin-reducing mastectomy with breast reconstruction with implants and nipple reconstructions.

are unwilling or unfit to undergo autologous tissue reconstruction.

### Contraindications

Patients are unsuitable for implant reconstruction if the chest wall tissues are very thin or if the mastectomy skin flaps are of uncertain viability. Radiotherapy significantly increases the risk of complications and diminishes the aesthetic result of implant/expander breast reconstruction.<sup>13,28,29</sup> Obesity is a relative contraindication.<sup>23,29</sup> This may therefore not be the best method of reconstruction if adjuvant radiotherapy is planned or has already been given.

### Surgical techniques

The inframammary fold is an important landmark for implant reconstruction that can be preserved safely during mastectomy and should be recreated if it has been violated. Careful choice of the expander is important, and the size should consider the base width, height and projection of the normal, intact breast. When tissue expanders are placed under the pectoralis major muscle and the inferolateral portion may be covered by ACM, serratus fascia if preserved by the resecting surgeon, or the serratus anterior and external oblique muscles in a submuscular plane to reduce palpability and improve lower pole and inframammary fold aesthetics.

There is growing popularity for using ACM, initially derived from human, porcine or bovine skin, although there is now a wide variety of allo- and xenograft as well as synthetic products, including shaped and perforated designs, to cover the inferolateral portion of the implant (**Fig. 13.4**). This potentially allows a one-stage direct-to-implant reconstruction or shortens the time taken for expansion (**Fig. 13.5**). This technique expands the indications for implant-based breast reconstruction, but it must be acknowledged that reconstruction of larger breasts, higher intraoperative device volumes, and use of larger-sized ACMs are independent risk factors for early complications.<sup>29</sup>



**Figure 13.4** • One-stage reconstruction after mastectomy with ACM to cover the inferolateral portion of the implant.



**Figure 13.5** • Bilateral risk-reducing nipple-sparing mastectomies with ACM and direct-to-implant reconstruction and lipofilling.

The use of ACM is associated with an increased rate of seroma, although the relationship with reconstructive failure is unclear.<sup>17</sup>

Care should be taken when planning the mastectomy incision to avoid exposing the ACM in case of delayed wound healing. Re-excision of any traumatised mastectomy wound edges prior to closure is often helpful. An alternative in immediate reconstruction of large ptotic breasts is to perform a skin-reducing mastectomy and use the de-epithelialised lower skin flap sutured to the caudal edge of the pectoralis major muscle to cover the inferolateral portion of the prosthesis as a vascularised dermal flap as an alternative to use of ACM, although a contralateral breast reduction procedure is usually necessary (**Fig. 13.6**). A policy of timely debridement of full-thickness mastectomy skin flap necrosis once it has declared, as well as early aggressive antibiotic intervention in the case of infection, are required to reduce the rate of early device explantation and reconstructive failure.

Tissue expansion is most commonly used in immediate breast reconstruction but can also be used in the delayed setting. The expander is only partially inflated



**Figure 13.6** • Bilateral mastectomies with inferior dermal flap and direct-to-implant reconstruction.

at insertion to allow closure of overlying mastectomy skin flaps without tension whilst optimising pocket fill and reducing potential deadspace. The actual expansion starts 1–2 weeks postoperatively following an interval for healing and is usually performed at weekly intervals; the volume of expansion at each occasion is guided by patient comfort. The creation of ptosis is improved by using anatomical expanders, in particular those with directed lower-pole expansion. Once expansion is completed, the expander is left in place for 6 weeks to 3 months to allow the skin envelope to maintain its stretch permanently. Following radiotherapy it is typically necessary to wait for 6 months or more before exchange to definitive reconstruction, although individual appraisal of the skin and soft tissue quality following irradiation may allow earlier exchange. In selected cases following irradiation, fat grafting of the mastectomy skin flaps in advance of exchange can be helpful to improve soft tissue quality and improve outcomes. The expander is then removed, a capsulectomy or capsulotomy is performed, and a definitive implant is inserted based on the width and height of the pocket and the desired projection. Capsulorrhaphy can be helpful in exchange to anatomical devices to reduce the risk of device rotation.

Revisional procedures are often required to optimise the aesthetic appearance of the reconstructed breast, and fat grafting is commonly performed, in particular to the upper medial pole. In addition, mastopexy, reduction or augmentation of the contralateral breast are often required to improve symmetry. The long-term aesthetic results of implant-based reconstruction can be expected to decline with time, independent of the implant type or volume, due to gradual ptosis of the contralateral side and failure of the implanted side to undergo normal ptosis, leading to late asymmetry, as well as capsular contracture of the reconstructed breast, in particular following radiotherapy.<sup>30</sup>

This procedure requires approximately 1 hour of operating time in addition to the mastectomy, a short period of hospitalisation and 2–4 weeks of recovery time.

## Complications

Early complications include haematoma, infection, seroma, mastectomy skin flap necrosis and wound dehiscence, and late complications include implant rupture/deflation, capsular contracture, implant malposition/rotation, implant rippling, extrusion and asymmetry. The commonest and least predictable complication of implant reconstruction is capsular contracture, which may lead to firmness and visible distortion of the breast, as well as pain in advanced cases, and may warrant surgical revision. Subsequent fat grafting or lipofilling often improves tissue quality and cosmetic outcomes.

The risk of capsular contracture is significantly increased following radiotherapy, and even with consideration of radiation delivery techniques, the complication rate for implant-based breast reconstruction in the face of radiation therapy is high.<sup>31</sup> In addition, radiation has a deleterious effect on health-related quality of life in patients with implant-based reconstruction.<sup>32</sup>

✔✔ Implant-based breast reconstruction is a suitable option for those unwilling or unfit to undergo autologous reconstruction. Patients do, however, need to be counselled that the results tend to deteriorate with time due to capsular contracture and failure of the implant side to undergo normal ptosis, as well as gradual ptosis of the contralateral side leading to late asymmetry<sup>30</sup> (Fig. 13.7). In addition, all implants have finite lifespans and may need replacement due to implant rupture or capsular contracture.

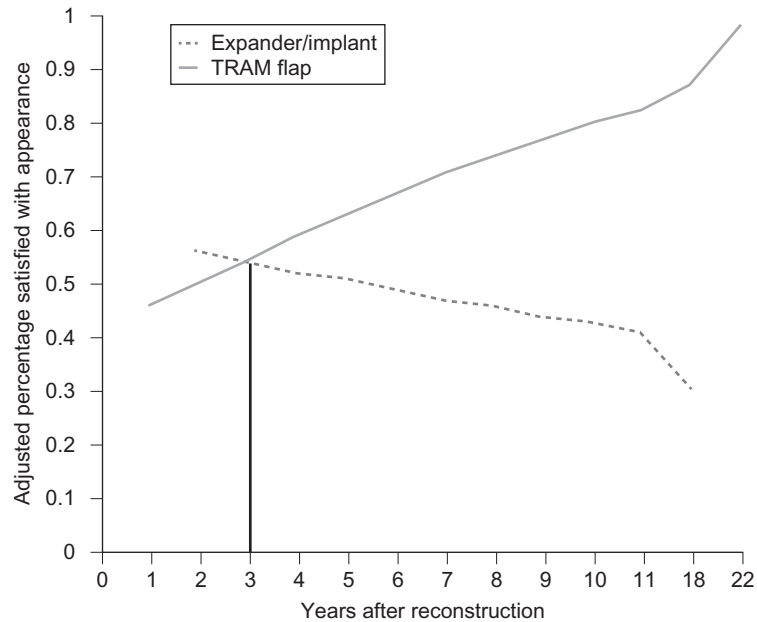
## The silicone issue

In the UK the Independent Review Group in 1998 concluded in an exhaustive report that silicone breast implants are safe, and no new contradictory evidence has arisen since the publication of the report.<sup>33</sup>

✔✔ The Independent Review Group considered immense amounts of complex evidence and reached a number of conclusions, including that there is no histopathological or conclusive immunological evidence for an abnormal immune response to silicone from breast implants in tissue, and that there is no epidemiological evidence for any link between silicone gel breast implants and any established connective tissue disease.<sup>33</sup>

## Breast implant-related anaplastic large-cell lymphoma (ALCL)

Breast implant-associated anaplastic large-cell lymphoma is a rare type of T-cell lymphoma that arises around breast implants, and although current



**Figure 13.7** • Cross-sectional graph displaying the adjusted percentage satisfaction with reconstructed breast appearance by procedure type and time from reconstruction. Of the women who had undergone reconstruction 1–3 years earlier, similar proportions of patients were aesthetically satisfied in each group. However, of the women in the longer post-reconstructive period, there was a significant divergence, with a greater proportion of TRAM patients reporting aesthetic satisfaction compared with expander/implant patients.

From: Hu ES, Pusic AL, Wajee JF, et al. Patient-reported aesthetic satisfaction with breast reconstruction during the long-term survivorship period. *Plast Reconstr Surg* 2009;124(1):1–8.

evidence is limited, it appears to be related to surface texturing of the expander or implant. In the majority of patients, it is a clinically indolent disease, but there is a subset of patients in whom the disease is progressive and may result in death. ALCL characteristically presents with a late seroma. Any seroma fluid evident should be aspirated and sent for cytology. If there is no evidence of ALCL the seroma should be treated symptomatically either with repeated aspiration, triamcinolone injection or surgery. Surgical management of patients shown to have ALCL with total capsulectomy and breast implant removal produces excellent overall and event-free survival. Patients who receive breast implants as part of their reconstruction need to be advised of the risk, albeit that the risk is very low, of developing the condition, as well as information of common presenting symptoms including a mass or delayed onset (>1 year) seroma.<sup>34</sup>

## Autologous breast reconstruction

### Background

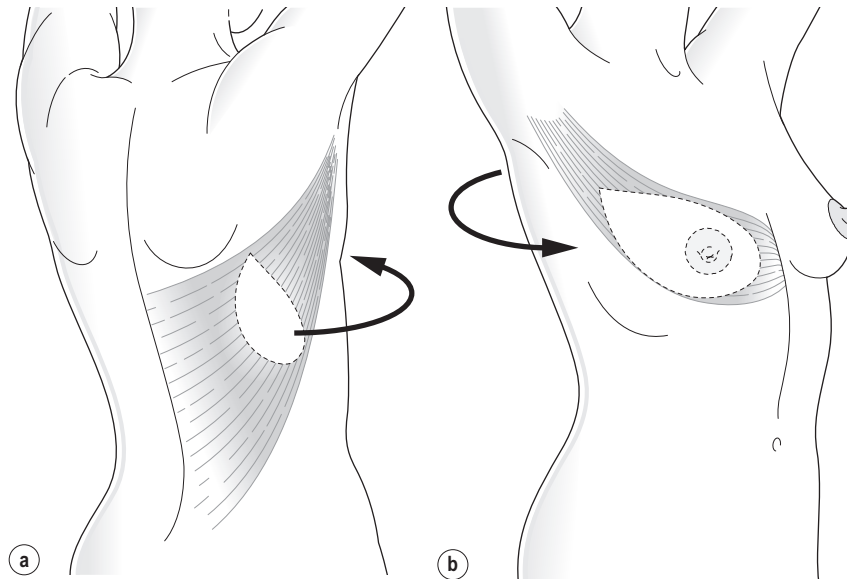
Autologous breast reconstruction allows the creation of a breast whose texture and appearance reasonably match that which has been lost. In

addition, the aesthetic result of autologous breast reconstruction tends to improve with time.<sup>30</sup> Options include the latissimus dorsi (LD), free muscle-sparing transverse rectus abdominis musculocutaneous (MS-TRAM), and deep inferior epigastric artery perforator (DIEP) flaps, and the thigh-based transverse upper gracilis musculocutaneous (TUG) and profunda artery perforator (PAP) flaps. The pedicled TRAM flap remains an option in selected cases.

Autologous reconstruction is indicated for both immediate and delayed breast reconstruction, following adjuvant chest wall or previous breast radiotherapy, in patients with moderate or large ptotic breasts, and in patients where previous implant reconstruction has failed. Abdominal flap reconstruction is ideal for those patients in whom an aesthetic abdominoplasty may be seen as an advantage.

### Latissimus dorsi (LD) flap reconstruction

The LD flap may be used either as a muscle-only or musculocutaneous flap. With its excellent blood supply to the overlying skin it affords a variety of skin paddle designs that can be hidden within the bra strap lines (Fig. 13.8). It is usually combined with an implant and reduces clinically evident capsular contracture



**Figure 13.8** • Illustration of breast reconstruction using an extended latissimus dorsi musculocutaneous flap without implant.



**Figure 13.9** • Immediate right breast reconstruction with extended latissimus dorsi flap combined with a very small implant.



**Figure 13.10** • Bilateral skin-sparing mastectomies and reconstruction with bilateral extended latissimus dorsi flaps without implants.

and rippling of the prosthesis (**Fig. 13.9**). The extended LD flap includes the subcutaneous fat overlying the muscle deep to the superficial fascia to increase volume and reduce the chance of requiring an implant (**Fig. 13.10**). Where volume is still deficient with this method, fat grafting can be performed immediately or in a delayed fashion to provide the necessary volume without the need for an implant (**Fig. 13.11**).

The pedicled LD flap has the lowest flap failure rate of the autologous reconstructions available and may be indicated in patients who are higher risk for autologous reconstruction. The indications include patients unwilling to accept the risk profile and recovery times associated with free flap surgery and in cases where the abdomen is unsuitable as a donor site either due to insufficient tissue volume



**Figure 13.11** • Right skin-sparing mastectomy with immediate extended latissimus dorsi flap reconstruction with immediate lipofilling and synchronous contralateral mastopexy for symmetry.



or the presence of multiple scars, or where the deep inferior epigastric pedicle has been previously ligated. Disadvantages include a scar on the back, possible shoulder stiffness and possible impairment of upper limb function. The functional deficit of the upper limb has been investigated in multiple studies, and although the absence of the LD is well compensated for by the teres major muscle, it is necessary to counsel patients who have high demands of their upper limb for activities involving shoulder extension and adduction, such as climbing and swimming, that this option may result in some functional deficit. Postoperative physiotherapy may be required to restore full shoulder mobility. The skin from the back is thicker than that of the native chest skin and the colour match may be different, and this needs to be taken into consideration.

The procedure generally requires 3–5 hours operating time, a hospital stay of 5–7 days and a recovery time of 4–8 weeks.

### Indications

Indications for this technique include the reconstruction of moderate to large ptotic breasts, if the chest wall tissues are unsuitable for tissue expansion, or if additional skin needs to be imported following mastectomy. Additional indications include chest wall reconstruction in locally advanced breast cancer, partial breast reconstruction after breast conservation surgery, or for salvage following loss of an abdominal tissue flap.

### Contraindications

The LD flap is contraindicated where it is suspected that previous surgery has damaged the flap pedicle, such as a thoracotomy or extensive and radical axillary surgery, congenital absence of the LD muscle, and significant patient comorbidity.

### Flap options

The LD flap is most commonly used as a musculocutaneous flap with either an oblique or horizontally orientated skin paddle. Transverse scars or a horizontal paddle in the bra line leave the best back scars. A muscle-only flap can be used where no additional skin is required, and where only skin is required, a muscle-sparing or thoracodorsal artery perforator flap may be used.

### Preoperative planning

The presence of the LD muscle should be confirmed prior to surgery by asking the patient to push down onto their hips and palpate the anterior axillary fold for muscle contraction. This is also particularly important following previous axillary surgery to indicate that the pedicle is likely to be intact, as the nerve lies in close proximity. Next it is important to decide how much skin needs to be replaced and

to test the amount of skin that can be taken from the back whilst allowing closure of the donor site, taking into account skin-fold thickness. This is usually between 6 and 9 cm in width, with a lesser amount of skin taken in high-risk patients such as smokers to reduce tension and hence the risk of wound breakdown, and approximately 20–25 cm in length. In our experience using the extended LD flap, the total volume in a lean back can be expected to be approximately 200 cm<sup>3</sup>, an average back 400–700 cm<sup>3</sup> and a variable amount more can be harvested in larger backs. The flap volume may be increased using immediate or delayed fat grafting.

### Surgical technique

The patient is positioned in the lateral decubitus position and secured with well-padded table attachments or a bean bag with the arm supported at 90°. Infiltration of the incision lines is performed using local anaesthetic with adrenaline to reduce postoperative pain, induce haemostasis and facilitate location of Scarpa's fascia through tissue tumescence where an extended LD flap is planned. The plane of dissection in an extended flap is best performed immediately deep to Scarpa's fascia to preserve the blood supply to the back skin. The fascial plane is often most easily identified in the central aspect of the incision. Additional areas of subcutaneous fat harvest include the parascapular area, fat anterior to the anterior border of the muscle and the supra-iliac fat deposits where flap vascularity permits.

The anterior border of the LD muscle is usually identified first. The muscle can then be raised from cephalad, posterior and inferior. Dissection then proceeds under the anterior border with care to avoid inadvertently including slips of serratus anterior muscle with the flap. The thoracodorsal neurovascular pedicle and the serratus branch are identified and preserved. The serratus branch can allow retrograde flap perfusion if the thoracodorsal pedicle has been previously damaged. The posterior part of the tendon insertion into the intertubercular groove of the humerus may be divided to allow additional mobility to the flap if required. A high axillary tunnel is fashioned to allow transposition of the flap whilst avoiding the risk of lateralisation of the flap into the axilla. Flap haemostasis is checked prior to transfer anteriorly, and the flap is transferred to the mastectomy wound, with care not to twist the pedicle. It is also important to check that there is adequate room for the pedicle without risk of compression prior to transfer – four finger-breadths is usually adequate. On occasions where additional reach is required, the humeral insertion can be divided fully and reattached anteriorly to the tendon of the pectoralis major muscle, and the serratus branch ligated. Some surgeons divide the

thoracodorsal nerve routinely at the level of the pedicle by excising a segment to avoid postoperative muscle twitching and flap animation and although it was thought that denervation may decrease the flap bulk over time due to atrophy, recent studies have shown no volume loss over time. Muscle twitching also tends to decrease with time in those where the nerve is preserved and is rarely a problem.

The donor site may be quilted to reduce the tension on the closure and reduce postoperative seroma. Drains are inserted and the wound is closed in layers. The patient may then be repositioned in a supine position for flap inset. The flap is sutured and shaped to create a breast mound, drains are inserted and the skin is closed in layers. The flap should be sutured to the base of the mastectomy flaps rather than the chest wall.

The patient is encouraged to wear a well-supporting brassiere for 6 weeks postoperatively. Physiotherapy may be instituted to help with shoulder rehabilitation.

### Complications

Early postoperative complications include haematoma, infection, breast skin necrosis, partial or complete flap failure or wound breakdown. Late complications include seroma and atrophy of the muscle portion of the flap. If breast implants have been used, then implant rupture and capsular contracture are long-term risks. Seroma formation is reduced by placing quilting sutures,<sup>35</sup> and once established, recurrence following drainage can be reduced by the use of intracavity steroid injections.

✓ Ischaemic complications of the LD flap are rare due to its robust blood supply, with a complete failure rate under 1%, and it is therefore a useful technique for autologous reconstruction in higher-risk patients.<sup>36</sup> Use of the LD flap appears protective for expander-implant reconstructions in previously irradiated breasts.<sup>37</sup>

### Breast reconstruction with lower abdominal tissue

The lower abdominal pannus can be an excellent source of tissue for autologous breast reconstruction and leaves an acceptable donor scar as well as serving as a simultaneous aesthetic abdominoplasty (Fig. 13.12). This technique achieves good aesthetic results that are stable with time.<sup>2,30,38</sup> It must be acknowledged that there is a risk of donor-site bulge and hernia with any technique that transgresses the anterior rectus sheath.<sup>39,40</sup> Despite the initial increased costs due to operation duration and inpatient stay, because of the decreased numbers of revisional procedures required, autologous

breast reconstruction is more cost-effective when compared with prosthetic reconstruction.<sup>41</sup>

### Indications

Lower abdominal tissue can be used for immediate or delayed breast reconstruction in any patient with sufficient tissue. For a microvascular procedure patients need to be surgically fit. Due to the versatility, resemblance to a normal breast and excellent long-term outcome, free lower abdominal flaps have become the first choice for breast reconstruction for most reconstructive surgeons.

### Contraindications

The only absolute contraindications are previous ligation of the flap pedicle or previous abdominoplasty. Multiple abdominal scars are a relative contraindication, as is previous abdominal liposuction, and imaging of the vascularity may be indicated in these cases. Midline abdominal scars may necessitate harvest of only a hemiflap, or use of a bipediced or stacked flap. The most predictable and safest outcomes in the presence of prior or anticipated radiotherapy involve the use of autologous tissue.<sup>13,14</sup>

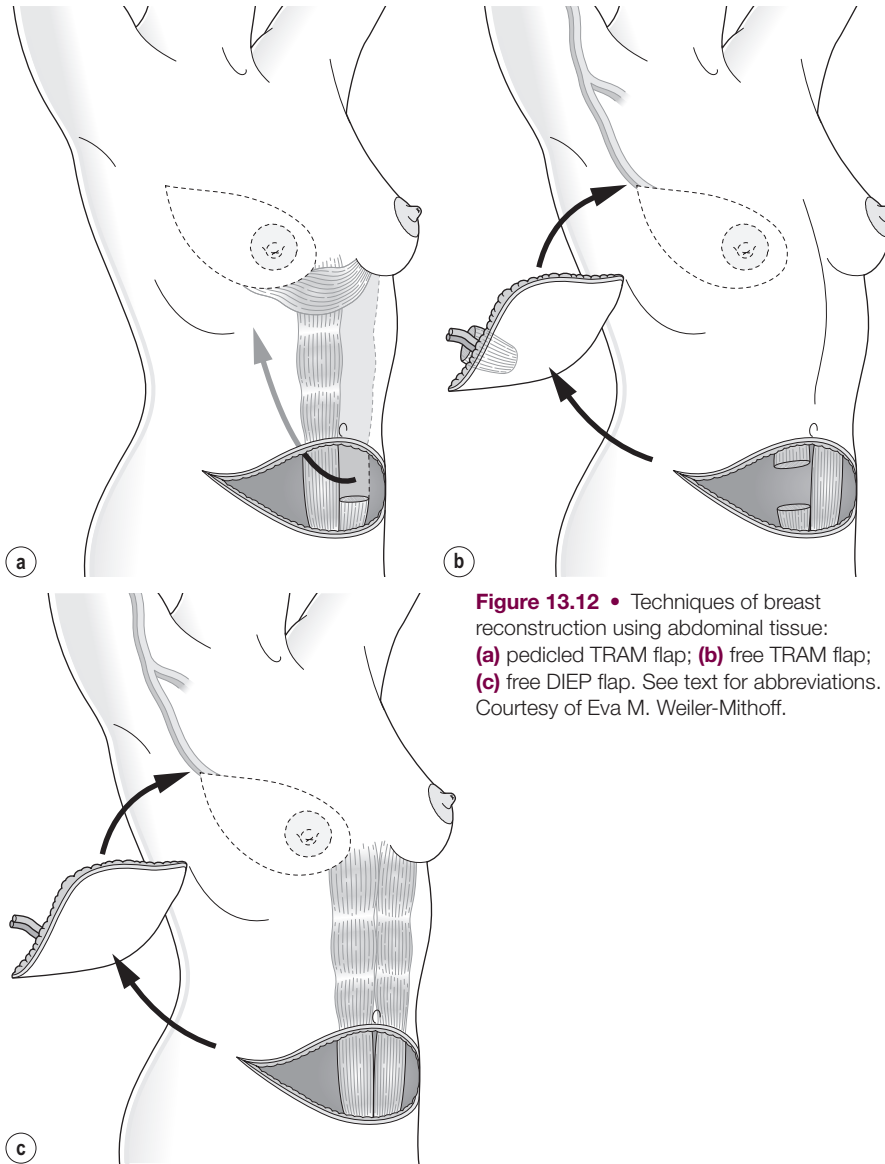
### Surgical techniques

The lower abdominal pannus receives its dominant blood supply from perforators of the deep inferior epigastric artery, a branch of the external iliac artery, through the rectus abdominis muscle. This vessel connects through reduced calibre vessels within the muscle with the deep superior epigastric artery, the terminal branch of the internal mammary artery. The blood supply to the pedicled flap therefore necessitates inclusion of the muscle and the venous drainage is retrograde. The lower abdominal flap also receives a variable contribution from the superficial inferior epigastric artery (SIEA), which lies superficial to the anterior rectus sheath.

The triple blood supply to the lower abdominal tissue allows it to be used in a variety of techniques, including the pedicled TRAM flap, free TRAM flap, free DIEP flap and free SIEA flap.<sup>40</sup> The free TRAM and DIEP flaps utilise the dominant blood supply and are associated with a reduced risk of flap complications compared with the pedicled TRAM flap. In addition, the potential to completely or partially preserve the rectus muscle and its intercostal motor nerves leads to reduced donor-site morbidity. It is important to counsel patients regarding the potential for abdominal donor site morbidity.

#### *Pedicled transverse rectus abdominis musculocutaneous (TRAM) flap*

The pedicled TRAM flap relies on blood flow through the deep superior epigastric vessels within the substance of the rectus abdominis muscle. The



**Figure 13.12** • Techniques of breast reconstruction using abdominal tissue: **(a)** pedicled TRAM flap; **(b)** free TRAM flap; **(c)** free DIEP flap. See text for abbreviations. Courtesy of Eva M. Weiler-Mithoff.

flap is transferred onto the chest wall through a large epigastric subcutaneous tunnel that may be either ipsilateral or contralateral. The only absolute contraindication is previous ligation of the deep superior epigastric artery pedicle. The flap does not require microvascular skills; however, perfusion through the non-dominant blood supply leads to higher rates of complications than the free flap, including fat necrosis and partial flap failure. For this reason, some surgeons advocate flap ‘delay’ by ligation of the ipsilateral deep and superficial inferior epigastric arteries before transfer, to allow augmentation of the remaining blood supply, especially in those considered high risk for flap

necrosis such as smokers and obese patients. As the full muscle width is required, the donor site needs to be reconstructed with prosthetic mesh and the donor-site morbidity is higher than with free flap options.<sup>39</sup> Bilateral pedicled TRAM flaps may further increase donor-site morbidity.

#### *Free transverse rectus abdominis musculocutaneous (TRAM) flap*

In many centres, free flaps from the lower abdomen are the first choice in breast reconstruction with autologous tissue (**Fig. 13.13**). The deep inferior epigastric vessels are the dominant blood supply for the free TRAM flap. The lower abdominal skin



**Figure 13.13** • Delayed right breast reconstruction with TRAM flap and with nipple reconstruction.

is transferred with a segment of rectus abdominis muscle to include the perforators and the deep inferior epigastric vessels, which are anastomosed to the recipient vessels of the internal mammary system or the subscapular axis. Muscle and fascial-sparing techniques are now widely used to reduce donor site morbidity compared with full-width muscle harvest and avoid the need for donor site reconstruction.<sup>39</sup> Due to the improved blood supply the rate of fat necrosis is reduced and a larger flap can be safely transferred compared with the pedicled flap. Many high-volume centres consistently achieve total flap failure rates of around 1–2%. The operation typically requires 6–8 hours operating time, a hospital stay of 5–7 days and postoperative recovery of 2–3 months.

#### *Deep inferior epigastric artery perforator (DIEP) flap*

The DIEP flap spares the whole of the rectus abdominis muscle through meticulous dissection of deep inferior epigastric artery perforators within the rectus abdominis muscle and preservation of the intercostal motor nerves (Fig. 13.14). This reduces the donor-site morbidity when compared with muscle harvesting flap techniques.<sup>42</sup> No muscle



**Figure 13.14** • Immediate left DIEP flap breast reconstruction and nipple reconstruction.



**Figure 13.15** • Bilateral nipple-sparing mastectomies with immediate DIEP flap reconstruction and lipofilling.

and little or no fascia is harvested and donor site reconstruction is rarely required. It is especially indicated in the young bilateral risk-reducing patient, where, combined with nipple-sparing mastectomy, it can lead to excellent aesthetic outcomes with high patient satisfaction (Fig. 13.15).

#### *Superficial inferior epigastric artery (SIEA) flap*

The SIEA flap is based on the superficial inferior epigastric artery and vein, which arise from the common femoral artery and saphenous bulb, respectively. Donor-site morbidity from SIEA flap harvest is minimal as the vessels are dissected at the level of Scarpa's fascia and the rectus fascia remains intact.<sup>40,42</sup> The main disadvantage of the SIEA flap is variability of the SIEA in presence, calibre and cutaneous territory. Vessels of at least 1 mm in diameter at the level of the inferior incision can be used safely for flap transfer. The vascular pedicle is short and therefore the internal mammary recipient vessels or their perforators are preferred, and flap inset requires special consideration due to the peripheral location of the pedicle. Perfusion of the flap across the midline is unreliable, and thus its use is limited to where only a hemiflap is required and for bilateral procedures.

#### Techniques

The flaps are harvested through standard abdominoplasty incisions extending laterally to the anterior superior iliac spines. Dissection is from lateral to medial, taking care to identify the superficial inferior epigastric pedicle. If the artery is of sufficient size, then a SIEA flap can be contemplated, otherwise the superficial inferior epigastric vein (SIEV) is dissected for a sufficient distance for use in case of venous compromise later. The perforators are inspected and if one dominant perforator or two or three smaller suitable perforators in the same intramuscular septum can be harvested then a DIEP flap is raised with

Careful intramuscular dissection of the perforators to the pedicle, which is located on the underside of the muscle. Where suitable perforators for DIEP flap harvest are not present, as much muscle as is necessary to incorporate the perforators is included and the dissection continues until a pedicle of sufficient length and calibre is obtained. Sensory nerves to the flap typically run with the perforators and may be connected to the lateral branch of the fourth intercostal nerve, although spontaneous recovery of sensation often occurs.

A two-team approach with simultaneous preparation of the recipient site and harvest of the flap works well. The internal mammary vessels are often preferred and can be approached either through excision of a segment of the third costal cartilage or through the interspaces above or below this; sometimes a perforator of sufficient calibre for anastomosis will be encountered. The anastomosis is performed and the flap inset and drains inserted, with a variable amount of de-epithelialisation performed depending on the amount of native breast skin that has been preserved. Because of its inadequate perfusion, the part of the flap furthest from the pedicle (zone IV) is often excised. The abdomen is closed in layers and the umbilicus resited as per an aesthetic abdominoplasty. Typically, suction drains are used.

✓ The DIEP flap provides the optimal free flap breast reconstruction in appropriately selected patients. The technique, however, is associated with a significant learning curve.<sup>43</sup> The SIEA flap has the lowest donor-site morbidity since the rectus sheath remains intact. This flap is limited to a hemiflap and can only be used in selected cases when the vascular anatomy is suitable. An algorithm is usually employed where the superficial inferior epigastric vessels to the flap are inspected first, and if these are not of sufficient calibre for a SIEA flap then the SIEV is dissected for a sufficient distance for harvest with the flap for secondary anastomosis should the flap develop venous congestion. Next the flap is harvested from lateral towards the midline and the perforators explored. If perforators of sufficient calibre are found to support a perforator flap, then a DIEP flap is harvested, and if not then a MS-TRAM flap is harvested to include the perforators.

### Complications

Early complications include thrombosis of the arterial or venous anastomosis, haematoma, partial or total flap loss, fat necrosis, wound breakdown, umbilical necrosis, and infection of donor site prosthetic mesh, if used. Late complications include donor-site bulge or hernia and reduced abdominal

**Table 13.1** • Pooled complication rates for DIEP and free TRAM flap patients (%)

	DIEP flap	Free TRAM flap
Fat necrosis	10.1	4.9
Partial flap loss	2.5	1.8
Total flap loss	2.0	1.0
Abdominal bulge	3.1	5.9
Abdominal hernia	0.8	3.9

DIEP, deep inferior epigastric perforator; TRAM, transverse rectus abdominis myocutaneous.

Modified from Man LX, Selber JC, Serletti JM. Abdominal wall following free TRAM or DIEP flap reconstruction: a meta-analysis and critical review. *Plast Reconstr Surg* 2009; 124(3):752–64.

strength (Table 13.1). Obesity and smoking are predictive of surgical site complications.<sup>44</sup>

### Superior and inferior gluteal artery perforator (SGAP/IGAP) flaps

A superior or inferior gluteal artery perforator (SGAP, IGAP) flap is indicated when the abdominal donor site is unavailable due to insufficient tissue or the presence of multiple abdominal scars, or if the patient wants a more inconspicuous donor-site scar.<sup>45</sup> The flaps are limited to small- to moderate-volume reconstructions and tissue is firmer and less able to create ptosis than that from the abdomen. The donor site, however, particularly with the IGAP flap, can be excellent in well-selected patients and recovery is shorter than with abdominal flaps. The internal mammary vessels are preferred for the anastomosis to aid inset, due to the relatively short pedicle. Care must be taken to avoid injury to the posterior cutaneous nerve of the thigh at the caudal aspect of the flap which can lead to paraesthesia of the posterior thigh.

### Transverse upper gracilis (TUG) flap

The TUG flap is a musculocutaneous flap that includes the gracilis muscle and overlying fasciocutaneous tissue. It is harvested as a transverse skin ellipse from the upper thigh, which is usually discarded in a traditional aesthetic medial thigh lift, based on musculocutaneous perforators through the gracilis muscle from the medial circumflex iliac artery. The flap may be harvested with the patient supine in the ‘frog-legged’ position, or in lithotomy. The tissue has similar pliability to that of the breast. The flap is indicated for reconstruction of small or moderate-sized breasts, where the volume harvested is typically similar to the mastectomy volume. The donor-site scar is very well hidden and there is good patient satisfaction. It is important to limit dissection over the femoral triangle and to preserve the long saphenous vein and its tributaries to avoid injury to the superficial lymphatic vessels and reduce the risk of lymphoedema.<sup>46</sup>

### Profunda artery perforator (PAP) flap

The PAP flap for breast reconstruction is a fasciocutaneous flap based on perforators from the profunda femoris vessels that pass through adductor magnus muscle posterior to the gracilis. The vascular pedicle is longer with greater calibre than that of the TUG flap, with a mean length of approximately 10 cm (range, 8–13 cm). The flap is harvested as a transverse ellipse typically designed more posteriorly than that of the TUG flap, taking advantage of the thicker and more abundant soft tissue of the thigh and, if desired, of the lower buttock. The skin paddle, and hence resultant scar, position is dependent on the perforator location on preoperative imaging with CT or MR angiography. One approach, however, is to use a common flap design and to raise the flap from posterior to anterior. If a suitable PAP perforator is found then the flap is raised on this vessel, and if not then a TUG flap is raised. In this situation the flap is harvested supine in the ‘frog-legged’ position, or in lithotomy. For posterior flap designs the patient is typically positioned prone. Due to relative ease of harvest, desirable tissue characteristics, and advantageous donor site scar location, the thigh-based flaps are considered by many to be the second choice for free autologous breast reconstruction in patients that are unsuitable for a free abdominal flap.<sup>47</sup>

### Alternative free flap donor sites

Alternative options for autologous tissue breast reconstruction in selected patients without a suitable abdominal donor site include the lumbar artery perforator flap, lateral thigh flap based on the lateral circumflex femoral artery, and the deep circumflex iliac artery perforator flap.

### Role of autologous fat grafting in breast reconstruction

Autologous fat grafting is an oncologically safe procedure following mastectomy or breast-conserving surgery for breast cancer.<sup>48</sup> Fat grafting can be performed to the mastectomy skin flaps in the setting of delayed reconstruction in order to mitigate against the effects of prior radiotherapy in advance of reconstruction with an implant or flap as well as improving the cosmetic results, and in the immediate setting to increase the mastectomy flap thickness and improve the aesthetic outcome without increasing the risk of mastectomy skin flap necrosis. The latissimus dorsi musculocutaneous flap can be volume augmented by immediate fat grafting if required to avoid the need for an implant (Fig. 13.16). All flaps can be volume augmented using fat grafting in the delayed setting using the vascularised matrix principle. The contour of the reconstructed breast can be



**Figure 13.16** • Delayed right breast reconstruction following previous mastectomy and adjuvant chest wall radiotherapy. Reconstruction using extended latissimus dorsi flap with immediate lipofilling.

improved by fat grafting, in particular the upper medial quadrant of the breast in the cleavage area. Fibrosis and contracture secondary to radiation to the implant or flap can also be significantly improved by delayed fat grafting. Areas of flap fat necrosis can be successfully corrected by a combination of liposuction and autologous fat grafting. The quality of abnormal scars can also be markedly improved by fat grafting. Donor sites should be carefully selected and include flanks, anterior abdomen, medial, lateral, or posterior thighs, buttocks and lower back, preserving future autologous donor sites where indicated and with care taken not to create secondary donor site contour abnormalities. After free abdominal flap reconstruction, liposuction to bilateral flanks and anterior abdomen for fat graft harvest can further improve the aesthetic appearance of the abdomen and lead to increased patient satisfaction. There is a degree of volume loss after fat grafting and patients should be warned that multiple treatment episodes may be required.

### Staged nipple-sparing mastectomy and immediate reconstruction following mastopexy

Patients desiring bilateral risk-reducing mastectomy with moderate or large ptotic breasts or with significant breast asymmetry may benefit from a staged reconstructive approach, with preparative mastopexy/reduction (Fig. 13.17). Staged nipple-sparing mastectomy after a delay of at least 4 weeks is then performed via the previous incisions, followed by immediate reconstruction.<sup>49</sup> The vascular delay may reduce the risk of necrosis of the nipple-areola complex and mastectomy skin flaps. Autologous fat grafting can also be performed as an adjunctive procedure if required to optimise the cosmetic outcome.



**Figure 13.17** • Staged reconstruction: bilateral mastopexies followed by delayed bilateral risk-reducing mastectomies and reconstruction with implants and lipofilling.

## Finishing touches

Further surgery may be necessary to the reconstructed breast, the contralateral breast, or the donor site of the autologous reconstruction. Nipple–areola reconstruction is usually reserved until after the breast reconstructive stages are complete and the final breast form is apparent.

## Surgery to the reconstructed breast

The reconstructed breast may require adjustment in size or shape by liposuction, mastopexy or augmentation. Fat grafting is useful for smoothing out contour irregularities and for adding volume to the reconstructed breast. Further adjustments of the position of the breast on the chest wall, improvement of projection, adjustment of the inframammary fold or revisional surgery for capsular contracture may be necessary.

## Surgery to the contralateral breast

Symmetrising surgery may be achieved by mastopexy, breast reduction or augmentation. Augmentation is particularly useful for gaining symmetry where implant breast reconstruction has been performed. Some patients may receive a contralateral risk-reducing mastectomy with reconstruction where they are deemed at high risk of contralateral breast cancer after a formal assessment of genetic risk.

## Surgery to the flap donor site

Scar revision, liposuction, fat grafting, treatment of persistent seroma, correction of dog ears, or repair of an abdominal bulge or hernia may be necessary.

## Nipple–areola reconstruction

Breast reconstruction is not complete until the nipple–areola complex (NAC) has been reconstructed, although some patients may be happy without this and customised prosthetic nipples are available.<sup>50</sup> NAC reconstruction is usually the last step of the reconstruction as its position is difficult to alter. The aims of NAC reconstruction are to achieve symmetry with the contralateral NAC in terms of size, colour, texture, position and projection. The ideal NAC reconstruction technique has not yet been discovered, as evidenced by the number of techniques that have been described. The challenge is to maintain nipple projection with time.

Nipple reconstruction techniques can be broadly categorised as either composite grafts from the opposite breast or local flaps. Nipple-sharing is ideal for women with a large, ptotic contralateral nipple and the cosmetic result can be very satisfactory (**Fig. 13.18**); however, this causes morbidity to the normal nipple and the graft may fail. Almost all local flaps suffer some loss of projection over time, usually at a rate inversely proportional to the thickness of the tissue used to create them. For this reason, an over-projected reconstruction is usually performed. The C-V flap or an associated modification is the most commonly used technique due to its simplicity and predictable outcome.<sup>50</sup> The use of autologous or prosthetic implants has also been described for placement within the local flap construct to try to maintain projection.

Areola reconstruction can be performed by full-thickness skin grafting or by tattooing. Grafts are usually obtained from the contralateral areola or the labia majora and aim to match the pigmentation and texture of the contralateral areola as closely as possible. For this reason, where the contralateral areola is not suitable, tattooing is usually preferred. It is a quick and simple technique with minimal morbidity and very few complications apart from fading with time, and may be performed either before or after the nipple reconstruction.



**Figure 13.18** • Right nipple reconstruction using composite graft nipple share from contralateral nipple.

✓ Patients should be offered nipple–areola reconstruction as an integral part of their reconstruction. It completes the reconstructed breast, leads to increased satisfaction with the reconstruction, a sense of completeness and an enhanced sense of attractiveness, especially when the patient is unclothed.<sup>50</sup>

## Complications of breast reconstruction

Mastectomy skin flap necrosis can complicate immediate breast reconstruction. Management may be conservative when the area involved is small, but larger areas are best treated surgically with direct closure or by split-skin grafting. Partial autologous flap failure requires debridement, dressing management and may necessitate skin grafting. Complete flap loss requires removal of the flap and either direct closure of the skin flaps, placement of a tissue expander or implant or immediate LD flap breast reconstruction, depending on the patient's wishes and medical condition. Implant infection or extrusion usually requires removal of the prosthesis (Fig. 13.19) and replacement later once the tissues are healed and free from infection. Contour defects



**Figure 13.19** • Infected prosthesis after right breast reconstruction that required removal.

following fat necrosis, muscle atrophy, or following radiotherapy may be corrected by fat grafting.

## Local recurrence

Salvage surgery for chest wall recurrence is best managed in a multidisciplinary setting. The aims of surgery are local control of disease, palliation of symptoms and enhancement of the quality of remaining life. Chest wall reconstruction may be required, and importation of well-vascularised non-irradiated tissues may allow for delivery of further radiotherapy. Reconstruction of the resultant defect often requires extensive surgery utilising local flaps or abdominal advancement, regional flaps such as LD, pectoralis major and parascapular flaps, omental transposition, pedicled or free abdominal flaps or a combination of these techniques.<sup>51</sup>

An increasing issue is the management of patients with previous breast conservation who develop local recurrences and require mastectomy. These patients have higher risks of ischaemic complications of the mastectomy skin flap due to the effects of previous whole-breast radiotherapy and immediate autologous reconstruction is typically indicated.

## Summary

Breast reconstruction following mastectomy must aim to produce the most natural final breast appearance with a good level of symmetry. Decisions regarding breast reconstruction are best made by a fully informed patient within the setting of a multidisciplinary breast cancer team skilled to deliver the oncological surgery as well as the full range of commonly used breast reconstruction techniques. Breast reconstruction leads to a high level of patient satisfaction; however, careful preoperative counselling and psychological support are important parts of the pathway. Close collaboration between oncological and reconstructive surgeons and careful patient selection can achieve excellent outcomes for breast reconstruction in the majority of patients.

## Key points

- Breast reconstruction plays a significant role in the woman's physical, emotional and psychological recovery from breast cancer.
- Surgical options for reconstruction include the use of tissue expanders or breast implants and the use of pedicled or free autologous tissue.
- The most commonly used surgical techniques are two-stage tissue-expander-to-implant, one-stage direct-to-implant, LD musculocutaneous flap with or without implant, free or pedicled lower abdominal tissue, and free tissue transfers from the thighs or buttock region.



- Implant-based techniques require limited surgery initially without creating donor sites but can have significant limitations. The quality of the long-term result is often disappointing even with the latest available devices and materials, unless performed after bilateral mastectomy. Further procedures are often required for complications and maintenance. Despite symmetrising procedures, asymmetry may reoccur due to natural ongoing ptosis of the contralateral breast and fluctuations in body weight.
- Radiotherapy has deleterious effects on prosthetic reconstruction in many patients and increases the rate of reconstructive failure and capsular contracture.
- The long-term aesthetic results from autologous reconstruction are superior to those of implant-based reconstruction due to their versatility, more natural appearance, consistency, durability and tolerance of radiotherapy.
- The autologous LD flap is highly versatile, avoids the need for an implant, and has acceptable donor-site morbidity.
- The fasciocutaneous tissues of the lower abdomen are ideal for autologous breast reconstruction. Donor-site morbidity is proportional to the amount of muscle included with the flap, at the expense of a more complex procedure.
- Further surgery is often necessary following postmastectomy reconstruction, to the reconstructed breast, the contralateral breast, or the donor site.
- Nipple–areola reconstruction leads to increased patient satisfaction, and breast reconstruction is not complete until this is performed in patients who desire it.
- Salvage surgery may be required for complications of the reconstruction or for oncological reasons.
- It is important for any woman undergoing mastectomy to be able to make a fully informed decision about reconstruction. Information about different techniques and their advantages and disadvantages should be freely available.
- Due to the variable needs of individual patients, the reconstructive surgical team must be capable of providing the full range of reconstructive options.



#### Recommended videos:

A guide to breast reconstruction

- [https://m.youtube.com/watch?v=et\\_RKObXFh8](https://m.youtube.com/watch?v=et_RKObXFh8)

What is breast reconstruction?

- <https://m.youtube.com/watch?v=BiSL8E6Sckc>



Full references available at <http://expertconsult.inkling.com>

## Key references

11. Xavier Harmeling J, Kouwenberg CA, Bijlard E, et al. The effect of immediate breast reconstruction on the timing of adjuvant chemotherapy: a systematic review. *Breast Cancer Res Treat* 2015;153(2):241–51. PMID: 26285643.  
This systematic review of the current literature, including 14 studies representing 5270 patients who had received adjuvant chemotherapy, of whom 1942 had undergone IBR and 3328 mastectomy only, showed that IBR does

not necessarily delay the start of adjuvant chemotherapy to a clinically relevant extent. No statistically significant difference was found in the time between surgery and first dose of adjuvant chemotherapy in 285 patients undergoing wide local excision, simple mastectomy or mastectomy and immediate breast reconstruction with a variety of techniques.

19. Bezuhly M, Wang Y, Williams JG, et al. Timing of postmastectomy reconstruction does not impair breast cancer-specific survival: a population-based study. *Clin Breast Cancer* 2015;15(6):519–26. PMID: 26182990.  
Population study of all patients who underwent unilateral mastectomy for breast cancer. Of 6790 subjects included in the study, 209 (63%) and 122 (37%) underwent immediate and delayed reconstruction, respectively. Breast reconstruction, regardless of its timing, carried no increased risk of breast cancer-specific mortality compared with mastectomy alone.
30. Hu ES, Pusic AL, Waljee JF, et al. Patient-reported aesthetic satisfaction with breast reconstruction during the long-term survivorship period. *Plast Reconstr Surg* 2009;124(1):1–8. PMID: 19568038.  
Cross-section survey of women who underwent postmastectomy breast reconstruction. Although satisfaction with TRAM reconstruction remained relatively constant, satisfaction with expander/

implants was significantly less among those patients in the long term. Patients who had undergone implant reconstruction more than 8 years earlier, compared with those who had undergone implant reconstruction less than 5 years earlier, were significantly less satisfied with breast appearance, softness, and size.

33. Report of the Independent Review Group. Silicon gel breast implants. London: HMSO; 1998. The Independent Review Group considered immense amounts of complex evidence and reached a number of conclusions, including that there is no histopathological or conclusive immunological evidence for an abnormal immune response to silicone from breast implants in tissue, and that there is no epidemiological evidence

for any link between silicone gel breast implants and any established connective tissue disease.

35. Lee KT, Mun GH. Fibrin sealants and quilting suture for prevention of seroma formation following latissimus dorsi muscle harvest: a systematic review and meta-analysis. *Aesthetic Plast Surg* 2015;39(3):399–409. PMID: 25808821. Meta-analysis of 14 studies to reduce seroma-related morbidity following LD muscle transfer. Fibrin alone failed to reduce seroma-related morbidities compared with no intervention, while fibrin instillation combined with quilting suture halved the risk of seroma formation and significantly reduced total drainage volume and drain indwelling periods compared with quilting suture alone.