# Breast Cancer Patient and Reconstructive Consultation

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## 6.1 Introduction

Patients with primary or recurrent breast cancer having a mastectomy or very wide excision should be considered for whole or partial breast reconstruction. It is important to have reconstructive surgeons present at the multidisciplinary team meetings at which such decisions are made. For patients with larger operable invasive cancers, options other than mastectomy should be considered. This includes bilateral therapeutic mammaplasty which allows large areas of breast tissue to be excised and to leaves smaller symmetrical breasts. Another option in development for smaller breasted women who otherwise require mastectomy is wide local excision of the cancer and immediate breast lipofilling. Where there are options, these can and should be discussed with the patient. For those women who are deemed suitable candidates for whole or partial breast reconstruction, both the timing and the options for reconstructive surgery should be considered and discussed with the patient.

## 6.2 Guiding Principles in Breast Reconstruction

Treatment of the cancer should not be compromised by breast reconstruction. The need to achieve an aesthetically satisfactory breast reconstruction, however important this is to the patient, should not stand in the way of ensuring that any surgery removes all disease to limit local recurrence and radiation and systemic therapy is delivered in a timely manner to maximise long-term local and systemic control.

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One issue of concern is that if major complications develop after reconstructive surgery, then this could delay administration of radiotherapy and chemotherapy. The overwhelming body of evidence indicates that immediate breast reconstruction is safe and appropriate for most patients undergoing mastectomy and does not impact significantly on the timing of adjuvant therapy [1]. Furthermore, studies have indicated that, in general, better results are obtained with immediate reconstruction compared with delayed reconstruction because skin and other soft tissues can be preserved; these are normally removed as part of a standard mastectomy [2]. Good oncological surgery which removes all the breast tissue does not have to be destructive, and in most patients it is not necessary to remove all the skin over the breast, the nipple–areola complex or the pectoral fascia. This does not mean that excellent results cannot be obtained by delayed breast reconstruction [3].

In every centre there should be a multidisciplinary team approach to breast cancer management and a similar multidisciplinary approach should be available when considering breast reconstruction . Any surgical plan must incorporate information from all members of the breast management team, including the breast surgeon, radiologists, oncologists, pathologists, nurses and support staff. If a plastic surgeon who was not present at the multidisciplinary meeting is to be involved in the discussion about breast reconstruction, then that surgeon needs to be aware of what the patient has been told about her breast cancer and what options have been discussed with the patient. If risk-reducing mastectomy is planned, then the reconstructive surgeon needs to know whether it is to be a skin-sparing or nipple-sparing mastectomy before having any discussions with the patient. The best option for the patient is a joint consultation between the oncological surgeon and the plastic surgeon. In some centres the onocological surgery and reconstruction is performed by appropriately trained oncoplastic surgeons. It is imperative such individuals offer the same range of procedures that a combination of a breast oncological surgeon and a plastic surgeon can offer. If the

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oncoplastic surgeon is not able to offer free flap breast reconstruction, then onward referral to a suitable plastic surgeon should be arranged if a free flap is considered the patient's best option.

Breast reconstruction is not normally done in one operation, but typically requires two or three operations. Even if breast reconstruction is performed immediately, surgery to achieve true symmetry usually involves additional procedures in the ensuing months. This can include changing a tissue expander for a permanent implant, a nipple or areola reconstruction, revision of autologous tissue transfer, liposuction or lipofilling for contour refinement or scar revisions. Patients who undergo unilateral breast reconstruction often require a contralateral breast procedure such as mastopexy, augmentation, a reduction or even risk-reducing mastectomy. From the outset, the patient's expectations need to take account of the long-term reconstructive plan and patients need to be aware that to achieve good symmetry often requires more than one operation.

Patient preference and lifestyle are very important when planning reconstructive breast surgery. Patients may express a strong preference for one type of reconstruction and seek a particular reconstructive surgeon on the basis of the types of surgery the surgeon can offer. Although implant-based reconstructions are often considered simple, they can be far from simple to achieve good cosmetic results and require considerable expertise and are not without complications [3]. Patients who participate in sports or other activities that require significant abdominal strength may not wish abdominal flap operations. Certain lifestyles can dictate where scars should be placed, for instance when raising a latissimus dorsi (LD) flap, and so the reconstructive surgeon needs to be aware of the patient's occupation and other aspects of the patient's lifestyle prior to making any recommendation or discussing options with patients.

## 6.3 Patient Consultation

The main aim of the discussion dealing with breast reconstruction is to inform women regarding the reconstructive options that are available in general and that are appropriate for them in particular. The current advice is that women should be provided with verbal, written and photographic information regarding the full range of reconstructive options [3]. Any reconstructive options that are unsuitable for the individual patient should be specifically identified and the reasons explained. It is also important that women considering reconstruction are seen by specialist reconstructive surgeons. For many patients this will mean seeing more than one surgeon. Preferably, as outlined already, these surgeons should see the patient together and provide the patient with clear information on the reconstructive choices, and who will do what during any planned surgery.

Some concern has been expressed in relation to performing breast reconstruction in patients with advanced disease. This includes locally advanced and metastatic disease. There is evidence that removing the cancer even in patients with known metastatic disease improves their overall outcome [4]. This means that mastectomy with or without reconstruction should not be discounted in patients with metastatic disease. For these women, breast reconstruction is entirely feasible once appropriate systemic therapy has produced stabilisation of metastatic disease. In patients with locally advanced breast cancer, systemic therapy can produce dramatic responses allowing both greater tissue and greater skin preservation [5], and in patients who require mastectomy can make breast reconstruction an option for many women. Even in patients who have locally advanced cancer with skin involvement, breast reconstruction is possible with myocutaneous flaps.

When agreement has been reached that whole or partial breast reconstruction is appropriate for the patient; the aim of the reconstructive consultation is to evaluate the various reconstructive options against the background of the patient's wishes and expectations whilst considering the patient's suitability for any given technique.

There is a huge variation not only in the type of reconstructions different units perform but also in the percentage of patients who have immediate or delayed reconstruction across and between countries [1–3]. There is no scientific basis for this huge variation, and within countries steps need to be taken to ensure consistent availability of the whole range of reconstructive options in all regions and centres. It is important that centres that perform breast reconstruction compare their own use of different reconstructive techniques with those of other centres in the country in which they work. Patients should be informed of all their potential options and have the opportunity to discuss available options in detail. An important part of the initial consultation is that patients are made aware of the rates of postoperative complications and that they are given a realistic perspective on the pain and discomfort associated with the procedure, including realistic outlines of recovery time from each of the various operations and the necessity for most patients to undergo more than one procedure to obtain symmetry [3]. One audit showed patients were poorly informed in relation to the pain and discomfort involved and the time it took to recover after various procedures [3]; following the audit, various recommendations were made:

- Clinicians should act to better inform women about both the procedures they decide to undergo and the reconstructive options available.
- Clinicians should ensure that women are offered a full range of appropriate reconstructive options, whether or not these are available locally.

**Table 6.1** Complication rates as reported by patients at 3 months following mastectomy and immediate or delayed breast reconstruction

| | Postdischarge complications (%) | | |
|---|---|---|---|
| | Mx | IBR | DBR |
| Readmission for treatment or surgery | 10 | 16 | 15 |
| Wound infection requiring antibiotics | 19 | 25 | 28 |
| Unplanned removal of implant | – | 10 | 7 |
| Surgery to remove some or all of flap | – | 4 | 6 |

*Source* UK National Mastectomy and Breast Reconstructive Audit: third annual report 30 June 2010 [3]
*Mx* mastectomy, *IBR* immediate breast reconstruction, *DBR* delayed breast reconstruction

- Clinicians should give accurate data on postoperative complications to inform women about the risks of different operations.
- Women considering reconstruction should be informed preoperatively that the chance of requiring further surgery either during their initial admission or postoperatively is around one in ten.
- Women must be informed how to report their levels of pain and be able to access appropriate pain relief, and be provided with adequate psychological support following their surgery.

Complication rates, particularly implant loss, have been underestimated and in large series can be significant [3] (Table 6.1). The discussion should include the possible need for symmetrising surgery on the contralateral normal breast to obtain true symmetry.

Patients considering bilateral risk-reducing mastectomy and bilateral breast reconstruction are often referred through family history clinics after having discussed options, including screening and the use of currently available pharmaceutical agents to reduce breast cancer development.

Patients wishing to be considered for delayed partial breast reconstruction may attend because of asymmetry following breast-conserving surgery and radiotherapy. These patients attend to discuss possible reconstructive options because of the impact that breast asymmetry has on their everyday quality of life.

## 6.4 Assessing the Patient's Fitness for Reconstructive Surgery

There are a variety of factors which need to be considered when considering a patient's suitability for breast reconstruction, including age, co-morbidities, body mass index, smoking history, diabetes, steroid/other drug therapy and religious affiliation [6, 7].

### 6.4.1 Smoking

There are more than 4,000 chemicals in cigarette smoke, including nicotine and carbon monoxide [8]. One effect of nicotine is to cause vasoconstriction of the dermal–subcutaneous vascular plexus. This has important consequences as in reconstructive surgery many tissue flaps rely on this plexus for survival [9]. As well as inducing a hypoxic state and causing vasoconstriction, smoking can lead to increased platelet aggregation, which results in the formation of tiny thromboses in capillaries. This is detrimental to wound healing, which relies heavily on blood flow in newly formed capillaries. Smokers have higher levels of fibrinogen and haemoglobin, which increase blood viscosity and increase the likelihood of blood clotting, and blood flow can be reduced by up to 42 % in smokers [10]. The combination of decreased oxygen delivery to tissues, the thrombogenic effects of smoking and increased viscosity and reduced flow could be the reasons why wound healing in smokers is significantly impaired.

The link between smoking and wound healing was first documented in the 1970 s. Problems with wound healing in smokers have been documented at multiple sites in the body. One study of patients undergoing abdominoplasty found that smokers were 3.2 times more likely to have wound problems than non-smokers. The number of cigarettes smoked in this study was not, however, a reliable predictor of those likely to develop wound healing complications [11]. Facelifts in smokers have been reported to be associated with a 12.5 times increased risk of developing retroauricular skin necrosis compared with non-smokers [12]. A study of 425 patients undergoing mastectomy and breast-conserving surgery and after adjusting for other confounding factors identified smoking as an independent predictor for wound infection and skin necrosis regardless of the number of cigarettes smoked [13]. The odds ratio for infection was 2.95 for light smoking (1–14 g/day) and 3.46 for heavy smoking (more than 15 g/day). The odds ratio for necrosis and epidermolysis was 6.85 for light smoking and 9.22 for heavy smoking.

In patients undergoing pedicled transverse rectus abdominis myocutaneous (TRAM) flap breast reconstructions, the number of wound infections was higher in both current and former smokers [14]. Complications related to the reconstruction were significantly more likely in current smokers (odds ratio 3.9) and former smokers (odds ratio 3.5) than in non-smokers. A study by Padubidri et al. [15] looking at patients having TRAM flaps and tissue expanders

reported the complication rate using tissue expanders for smokers was 37.1 %, which was statistically higher then the 26.6 % for non-smokers. In the TRAM flap group, active smokers had a significantly higher overall complication rate and a significant increase, in particular, of mastectomy flap necrosis. A study of 716 patients having free TRAM flaps showed significantly higher numbers of abdominal flap necrosis, mastectomy flap necrosis and abdominal hernias in smokers [16]. Mastectomy skin flap necrosis occurred in 18.9 % of smokers and 9 % of non-smokers ($p = 0.005$). This study demonstrated a dose effect, with smokers who had a history of smoking more than a pack of cigarettes (20 cigs in a pack)a day for 10 years being at increased risk of developing problems compared with smokers who had smoked for a smaller number of pack-years (55.8 % vs 23.8 %). One observation in this study was that delayed breast reconstruction in smokers was associated with a significantly lower rate of wound complications compared with immediate breast reconstruction in smokers. The risk of wound complications in delayed reconstructions was in fact similar to the rate in non-smokers. Complications were also less common in women who stopped smoking 4 weeks or more before surgery. A study by Gill et al. [17] examined risk factors and associated complications in 758 patients having deep inferior epigastric perforator (DIEP) flaps for breast reconstruction and found the risk factors associated with breast or abdominal complications included smoking ($p = 0.001$), postreconstruction radiotherapy ($p = 0.001$), and hypertension ($p = 0.0370$). Smoking and postreconstruction radiotherapy were the only significant risk factors for fat necrosis in this study.

### 6.4.2 Interaction with Obesity and Diabetes

It is recognised that cigarette smoking, obesity, age, diabetes and nutrition are all factors which play an important role in wound healing. Smokers who are obese or who have diabetes are at an even greater increased risk of wound healing problems than smokers without these risk factors. McCarthy et al. [18] studied 1,170 patients undergoing expander/implant reconstructions. They maintained a prospective database which included the variables of age, smoking status, body index, history of diabetes, hypertension and/or radiation as well as the timing of the reconstruction (immediate or delayed) and the laterality of reconstruction. The chances of developing complications were 2.2 times greater in smokers and 2.5 times greater in women over the age of 65 years. Patients who were obese had nearly twice the odds of having a complication. The same was true for patients with hypertension. The odds of reconstruction failure were five times greater in smokers, and failure was nearly seven times greater in obese patients and four times more likely in those who had hypertension. This study concluded that smoking, obesity, hypertension and age over 65 years were all independent risk factors for perioperative complications following expander implant breast reconstruction.

### 6.4.3 Smoking Cessation

There is one small randomised clinical trial involving 108 patients on the effect of preoperative smoking intervention on postoperative complications; there were 40 patients in the control group and 68 patients in interventional group [19]. Patients assigned to intervention were given counselling and nicotine-replacement therapy. The study showed a significant reduction in complications in the interventional group, with a reduction in wound-related complications and the need for secondary surgery. In this study patients stopped smoking 6–8 weeks before surgery and did not smoke for 10 days after the operation. In the literature there is no consensus on the optimal duration of preoperative smoking cessation, but there is some evidence that there are potential benefits from even a brief period of abstention. Most studies are, however, retrospective studies and have inherent weaknesses in their design.

### 6.4.4 Diabetes Mellitus

Studying any risk factor in isolation is always difficult because patients with diabetes often have other associated risk factors, such as obesity. One study of skin-sparing mastectomy flap complications after breast reconstruction showed a significantly increased risk of skin-sparing mastectomy flap complications in diabetics [20].

## 6.5 Postmastectomy Radiotherapy and Its Impact on Breast Reconstruction

Indications for postmastectomy radiotherapy have expanded over the past decade. One study of 919 patients who had breast reconstruction separated them into three groups: mastectomy with postoperative radiotherapy before reconstruction ($n = 57$), immediate reconstruction then postmastectomy radiotherapy ($n = 59$) and reconstruction without postmastectomy radiotherapy ($n = 665$) [21]. Overall, the complication rates for patients having radiotherapy either before or after mastectomy were significantly higher than those for controls, 40 % versus 23 % ($p < .001$). Immediate reconstruction before postmastectomy radiotherapy increased both the overall rate of complications (47.5 % vs 23.2 %) and the rate of late

**Table 6.2** Options for breast reconstructionbreast reconstruction

| Technique | Indications for | |
|---|---|---|
| | Immediate reconstruction | Delayed reconstruction |
| Prosthesis | Small breasts | As for immediate reconstruction *plus* well-healed scar *plus* no radiotherapy[a,b] |
| | Adequate skin flaps | |
| Tissue expansion and prosthesis | Adequate skin flaps | As for immediate reconstruction *plus* well-healed scar *plus* no radiotherapy[a,b] |
| | Tension-free skin closure | |
| | Small to medium-sized breasts | |
| Myocutaneous flaps | Larger skin incision | As for immediate reconstruction |
| | Doubtful skin closure | |
| | Large breasts | Can be used if there has been previous radiotherapy |

[a] Unless using acellular dermal matrix
[b] Radiotherapy significantly increases complication rates

complications (33.9 % vs 15.6 %) compared with controls (both $p < .001$). Delayed breast reconstruction in patients who had either had or not had postoperative radiotherapy produced similar complication and satisfaction rates, but prior radiotherapy was associated with decreased aesthetic satisfaction compared with no postmastectomy chest wall radiotherapy, with only 50 % of patients being happy in the group who had radiotherapy compared with 66.8 % in those who did not have radiotherapy.

A particular issue when using implant-based reconstructions in patients likely to have breast radiotherapy is how best to manage these patients. The literature suggests that there is a significantly increased risk of capsular contracture and other secondary complications in patients who receive radiotherapy compared with patients with who have breast reconstruction with implants who do not have radiotherapy [22, 23]. Complications after irradiation of implants are also commoner than one sees in patients undergoing autologous breast reconstruction who received radiation [24]. Some prefer to delay breast reconstruction in patients in whom it is clear that postoperative radiotherapy is required, whereas others are happy to use implant or autologous reconstructions. This lack of consensus can make it difficult for patients who are likely to need postmastectomy radiotherapy when they are considering their options for reconstruction. They may receive conflicting advice from different individuals because individual surgeons differ in their approach to breast reconstruction in the presence of postoperative radiotherapy.

## 6.6 Evaluation of Candidates for Breast Reconstruction

Important factors in assessing whether patients are suitable for breast reconstruction and determining the optimal technique include assessment of a patient's general health, the body habitus, breast size and shape, extent of any mastectomy scar, site of any mastectomy scar, the thinness of the mastectomy flaps, previous radiotherapy, the smoking history and patient preference.

It is important to assess the quality of the tissue that is present and is likely to remain when performing a breast reconstruction. There is a need to determine the amount of skin and soft tissue required to create acceptable symmetry before being able to determine what might be appropriate options (Table 6.2).

## 6.7 Whole Breast Reconstruction: Patients with Newly Diagnosed Breast Cancer in Whom Mastectomy Is Recommended

### 6.7.1 Treating the Breast Cancer

For patients undergoing mastectomy as their primary surgical option, it is important not to delay removal of the cancer and removal of or biopsy of regional lymph nodes as this may impact on the patient's long-term prognosis. A recent audit showed a huge variation in the time patients waited for mastectomy alone compared with mastectomy and immediate breast reconstruction [3]. If it looks as though it is going to take a long time either for the patient to choose her reconstructive option or to assemble a team to perform a reconstructive procedure, then other options for the patient should be considered. One of these options, which is underutilised in many centres, is to give systemic therapy as the initial treatment. For premenopausal women and those postmenopausal women with large oestrogen-receptor-negative or human epidermal growth factor receptor 2 (HER2)-positive cancers, then neoadjuvant chemotherapy is an excellent option, particularly if the oncologist has already considered that it is likely the patient will receive chemotherapy in the adjuvant setting [5]. In

HER2-positive cancers, dramatic rates of complete disease response, including disappearance of ductal carinoma in situ, is possible with the use of neoadjuvant chemotherapy together with trastuzumab [25]. In postmenopausal women with large tumours, almost 80 % are oestrogen-receptor-positive and these cancers respond well to aromatase inhibitors [26, 27]. In such women, use of an aromatase inhibitor for a number of months to shrink the cancer will allow over half of these women to become suitable for breast conservation or they can take aromatase inhibitors for a few weeks as a temporary measure while consideration is given to the best form of reconstruction.

Should the scheduling of reconstructive surgery be delayed for any reason, then an option is to excise the invasive cancer through an appropriately placed incision that does not interfere with later breast reconstruction procedures. This can allow adjuvant systemic therapy to be administered prior to mastectomy and reconstruction.

A useful option in some patients is to perform an initial sentinel lymph node biopsy in a patient with an invasive cancer who has no obvious nodal disease on clinical and ultrasound assessment of the axilla. One of the values of preoperative axillary assessment using a combination of imaging with fine needle aspiration cytology and/or core biopsy or sentinel lymph node biopsy is that it allows assessment of the likelihood and extent of any axillary lymph node involvement. This helps evaluate the likely need for postmastectomy radiotherapy. Although there are some who believe that postoperative radiotherapy has limited impact on the cosmetic outcome of whole breast reconstruction, most surgeons believe radiotherapy has a significant negative impact on breast reconstructions, particularly if breast implants are being used [21–24], allowing them to delay reconstruction until the completion of treatment [28]. Knowledge of the likely requirement for postoperative radiotherapy can influence the decision to proceed with immediate breast reconstruction and, if so, then the preferred technique. Although there are some who believe that it is not possible, with any degree of certainty, to determine whether postoperative radiotherapy is likely to be needed, it is clear that it is possible, with a high degree of accuracy by preoperative assessment of the type and extent of the primary cancer in the breast and any nodal involvement, to predict those who are likely to need postoperative radiotherapy [28]. One major reason patients receive postoperative chest wall radiotherapy after mastectomy is multiple axillary node involvement, and thus an initial sentinel lymph node biopsy to assess the status of the axilla prior to mastectomy and consideration of reconstruction is a sensible approach. At the same time as sentinel lymph node biopsy is performed, it is also possible to remove the central subareolar ducts, and this can assist in a decision about whether the patient is suitable for nipple sparing during the mastectomy [29].

## 6.8 Choosing Options

### 6.8.1 Implants and Expanders

Breast implants and expanders are best suited for breast reconstruction in women with smaller breasts with thick mastectomy flaps and minor degrees of ptosis [30]. For women who wish to avoid major surgery involving donor sites and scars on other parts of their body, breast reconstruction using implants may be the option of choice. This technique is also worthy of consideration in patients considering bilateral mastectomy leading to a good level of post operative symmetry. When this is performed as a delayed procedure, a period of tissue expansion is required prior to the placement of the definitive implant. In the immediate setting, however, a skin-sparing approach during mastectomy improves the quality of the final result [31]. Total submuscular implant placement can sometimes lead to upward displacement of the inframammary fold. To address this problem, the site of origin of the pectoralis major muscle should be released or detached and the inferior pole of the implant should be covered with an acellular dermal matrix to achieve enhanced projection in this important area [32]. Good candidates for this technique have small to moderate-sized breasts, good quality skin and show an absence of established glandular ptosis. Young patients requesting bilateral risk-reducing surgery are good candidates for implant-based reconstructions using this technique. In older age groups, the technique may still lead to very satisfactory results when combined with symmetrising surgery on the contralateral side. Irradiated tissues rarely do well with implant-based breast reconstructions [32]. During the reconstructive consultation, the limitations of this technique for unilateral reconstruction must be communicated and the patient advised that symmetry is possibly usually only when clothed with the contralateral side supported in a bra.

### 6.8.2 Use of Tissue Matrices

A variety of tissues have been used to cover the lower pole of implants during breast reconstruction (Fig. 6.1). The problem with total muscular cover has been obtaining satisfactory inferior projection and reconstruction of a satisfactory inframammary fold. The tissue matrices in common use include those derived from human skin (Alloderm®), pig skin (Strattice and Permacol) and bovine skin and pericardium [32, 33]. Both synthetic and absorbable meshes have also been used. De-epithelialised lower mastectomy flaps are another option to improve lower pole fullness and provide sufficient cover of the implant where it sits below

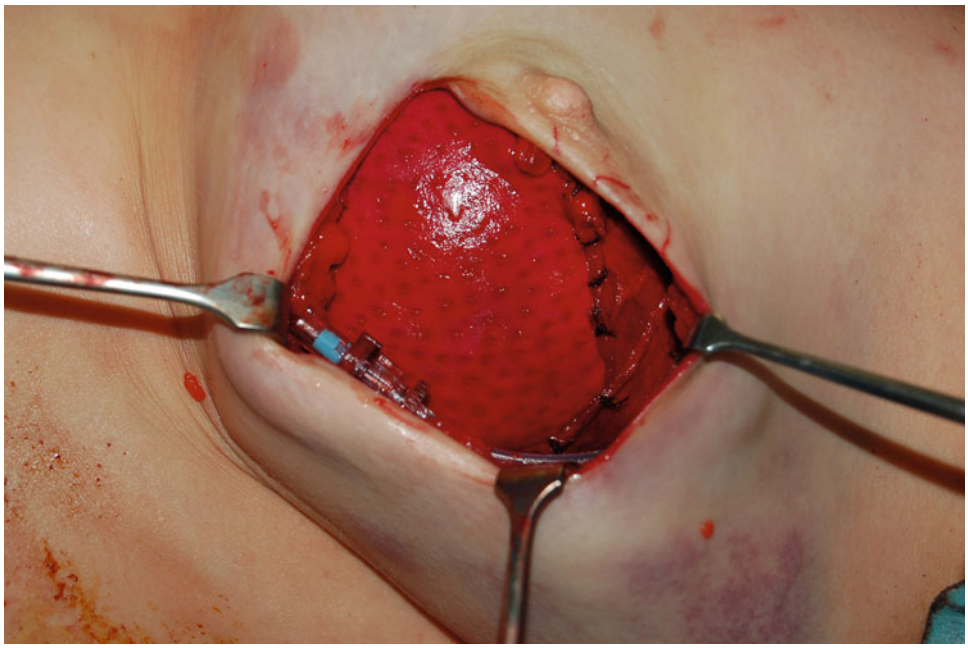

**Fig. 6.1** Strattice® used as a sling for breast reconstruction in a patient having a nipple sparing mastectomy

the lower margin of the pectoralis major muscles (Fig. 6.2). When tissue matrices are used meshes or de-epithelialised skin are used, the pectoralis major muscle is lifted from its site of origin and the tissue matrix, mesh or de-epithelialised flap is stitched between the cut edge of the pectoralis major muscle and the new inframammary fold [33]. This provides a sling for the lower part of the implant alone, Becker implant/expander or tissue expander. The option of de-epithelialising the lower flap of the mastectomy and suturing this to the edge of the pectoralis major muscle is less good at creating an inframammary fold than acellular dermal matrix [34]. The two can be combined to good effect when carrying out a skin-sparing mastectomy.

Complication rates with these various techniques can differ widely. Implant and tissue matrix loss rates can be as high as 15 % [33]. Particular care is needed when selecting the most appropriate incision, especially if a nipple-sparing technique is to be used. Any wound edge necrosis particularly over the tissue matrix or mesh is associated with a high rate of implant loss.

### 6.8.3 LD Flaps

Patients who are ideally suited for LD flaps include thin patients where the infraumbilical tissues are limited, and patients who have undergone previous abdominoplasty or other abdominal operations through abdominal scars that may have compromised the blood supply to the abdominal flap. The LD also appears more resistant to the effects of impaired wound healing in patients who smoke or who have diabetes [35]. Additionally, the LD does not compromise the abdominal wall, which may be an issue for patients considering future pregnancy. In patients considered for secondary reconstruction, the existing mastectomy scar may pose challenges to planning insertion of an LD flap. Compared with an oblique mastectomy scar, a vertical or horizontal scar can be difficult to conceal and may compromise projection of the reconstructed breast. If the flap is placed too high, then satisfactory ptosis and inferior pole projection cannot be obtained [36]. In patients with a very high scar, the flap can be inserted into a new incision placed in the inframammary fold incision. The main bulk of the muscle must be placed where it is required to create a breast mound which matches the opposite normal breast. One study comparing LD breast reconstruction with TRAM reconstruction found the LD flap was associated with fewer complications [37].

Until recently it has been traditional to combine an LD flap in most patients with insertion of breast implants. With the development of extended LD flaps, an increasing number of patients can have autologous breast reconstruction without the use of an implant [38]. The shape evolves over time, and it is important to inform women that the contour and shape will improve with time (Fig. 6.3). It is also possible to augment the volume of an LD flap by later lipofilling [39]. A major drawback of LD flaps is the high rate of seroma formation on the back [40].

### 6.8.4 TRAM and DIEP Flaps

Surplus tissue in the lower abdomen can be an excellent source of material when considering breast reconstruction. Typically, the reconstruction is performed without the need

**Fig. 6.2** Bilateral breast reconstruction on the right delayed, and the left prophylactic nipple-sparing mastectomy (following diagnosis of mutation in the *BRCA1* gene). Reconstruction was with Strattice®. The patient has a bilateral shaped prosthesis

**Fig. 6.3** Reconstruction in transition. A patient who underwent a right breast reconstruction with an extended latissimus dorsi (LD) flap. Photograph were taken regularly by the patient over a 3-month period after surgery

for breast implants, and the final result may be indistinguishable from the native breast when reconstruction is performed in ideal circumstances. The transfer may be achieved as a pedicled muscle flap or as a free tissue transfer either incorporating part of the rectus abdominis muscle (TRAM) or based purely on the perforating branches of the deep inferior epigastric artery (DIEP) [33, 41, 42]. Prior abdominal operations require careful evaluation to ensure the axial vessels are likely to be intact and that pre-existing scars will not impact adversely on the abdominal closure or interfere with successful wound healing. The patient's general health should be good and cigarette smokers should be advised to stop smoking for at least 3 months prior to surgery where circumstances allow [15]. Cigarette smoking significantly increases the risk of complications, and these patients may be served better by a procedure with a lower risk profile. There is also a well-recognised risk of total flap failure of around 3–5 %, which

again is higher in smokers, and of abdominal wall bulging or herniation, and these factors when combined with a longer recovery period compared with other techniques may significantly influence a patient's decision to proceed with this surgery. Where circumstances are favourable, however, fully autologous lower abdominal breast reconstructions produce durable results with high levels of patient satisfaction in both immediate and delayed settings [3].

### 6.8.5 Other Free Flaps

There are a range of other free flaps that have been described as options for breast reconstruction . These include superior and inferior gluteal artery perforator flaps and the transverse upper gracilis flap [33].

These flaps are usually offered only by specialist plastic surgeons and are used mostly in patients who are not suitable for other options [33].

### 6.8.6 Skin-Sparing Mastectomy

The goal of breast reconstruction is to achieve an aesthetically pleasing breast resembling as closely as possible the native organ, or at the very least to achieve a result that can be matched by the minimum of additional surgery to the contralateral side. The preservation of as much native breast skin as possible at the time of mastectomy brings significant advantages in terms of both final breast shape and overall aesthetic appearance when combined with immediate breast reconstruction [43, 44]. A body of evidence now exists supporting the oncological safety of this technique [45–50]. These data show skin-sparing mastectomy can be performed without compromising local disease control. Carlson et al. [51] have provided a 10 year retrospective review of 539 patients treated for 565 cases of breast cancer by skin-sparing mastectomy and immediate breast reconstruction. The local recurrence rate with an average 65 month follow-up was 5.5 %, and the local recurrence rates increased as the disease stage at presentation increased. These rates of local recurrence are comparable to those for total mastectomy and nipple excision [52]. In an earlier publication, Medina-Franco et al. [47] reported a local recurrence rate of 4.5 % with median follow-up of 6 years in 173 consecutive patients undergoing skin-sparing mastectomy and breast reconstruction. A skin-sparing approach to mastectomy is therefore both desirable and safe and should be considered whenever breast reconstruction is planned. Nipple-sparing mastectomy is also possible in patients with cancers, and is discussed later.

### 6.8.7 The Opposite Breast

Symmetry is the primary focus of breast reconstruction . This is often difficult to achieve in many patients. Selection of one or another technique for breast reconstruction is influenced not only by the amount of skin that very occasionally needs to be removed during the surgery to excise the breast cancer but also by the appearance of the remaining breast, including any possible procedures that may be advised on the opposite breast to achieve shape and/or volume symmetry (Table 6.2).

It is of upmost importance to consider the opposite breast in the initial breast reconstruction plan. For this reason it is important to discuss with the patient, prior to any operation, what the options are for the opposite breast if symmetry is to be obtained. The reconstructive surgeon should, however, appreciate that most patients prefer to leave their opposite breast unscarred and untouched if possible. If the breast that is to be matched is well shaped without excessive ptosis, the goal of breast reconstruction should be to match it. If the opposite breast is large or small in relation to the patient's body habitus, then the options of enlarging or reducing the opposite breast should be considered and discussed. Even if the opposite breast is of adequate volume, it may be necessary to consider a mastopexy if one is going to obtain symmetry of contour as well as symmetry of volume.

One option for the opposite breast is prophylactic mastectomy. Such an operation attempts to reduce the possibility of breast cancer developing in the opposite breast in women at high risk and it can ease some patients' fears that they have about cancer development in the opposite breast (Fig. 6.2). The patient must, however, be guided in this by discussions and input from the multidisciplinary team before this approach is selected. Of concern is that studies have shown a recent dramatic increase in the number of woman having prophylactic contralateral mastectomy [53]. Studies of women having such procedures have shown that most of these women are not at significantly heightened risk of developing a contralateral breast cancer [54]. Significant risk factors for having a prophylactic contralateral mastectomy include having a breast MRI and having a breast reconstruction [55, 56] (Table 6.3). Although it is true that it is easier to obtain symmetry when similar procedures are performed on both breasts, this in itself is not sufficient reason to remove a normal contralateral breast which is not at significant risk of breast cancer development. With adjuvant hormone therapy the rate of contralateral breast cancer development is less than 4 per 1,000 per year, although that risk persists over a 20–30 year period [54]. Even for those patients who develop a contralateral breast cancer, mastectomy is not always necessary. Only in patients with a strong family history with or without the

**Table 6.3** Predictors of contralateral prophylactic mastectomy by multivariate analysis

| | Odds ratio | *P* value |
|---|---|---|
| Age < 50 years vs age ≥ 50 years | 2.3 | <0.0001 |
| Race (white vs other) | 3.6 | <0.0001 |
| Family history of BC | 2.9 | <0.0001 |
| DCIS vs IDC | 1.9 | 0.0003 |
| ILC vs IDC | 0.9 | 0.6465 |
| Reconstruction vs no reconstruction | 3.2 | <0.0001 |
| MRI at diagnosis | 2.2 | <0.0001 |
| Breast-conserving surgery attempted | 1.7 | 0.0014 |

*Source* From King T, Sakr R, Gurevich et al. (2009) Clinical management factors contribute to the decision for contralateral prophylactic mastectomy (CPM). San Antonio Breast Cancer Symposium. abstract 38. Odds ratios were adjusted for the surgeon
*BC* breast cancer, *DCIS* ductal carcinoma in situ, *IDC* infiltrating ductal carcinoma, *ILC* infiltrating lobular carcinoma

knowledge that the patient is carrying a mutated *BRCA1* or *BRCA2* gene and in patients with atypical hyperplasia affecting a breast together with a significant family history should prophylactic mastectomy be considered as essentially a therapeutic procedure. There is some information that suggests patients who have a contralateral mastectomy at diagnosis have a better outcome than those who have a unilateral mastectomy [57]. This information is not from randomised studies, and is inconsistent with the number of women who die from contralateral breast cancer [54]. Providing appropriate surveillance of the other breast is continued on a regular basis as development and treatment of a contralateral breast cancer does not appear to compromise outcome [54].

## 6.9 Revisional Surgery Consultation

A number of patients who have had reconstructions which were initially symmetrical and satisfactory attend consultations to discuss revisional reconstructive surgery. The untreated breast increases in size and in develops increasing ptosis over time, whereas the reconstructed breast, with the exception of autologous reconstruction, tends to remain the same size or even shrinks if the patient has had radiotherapy. The same range of reconstructive options are available to these patients as to patients who have had an immediate reconstruction. Options may be limited, depending on what procedures they have had previously and whether the patient has received prior radiotherapy. Revising and improving a patient's reconstruction can be more complex than a primary breast reconstruction. Considerable expertise in this area is required if an individual surgeon is to offer such an option. To obtain symmetry it is usually necessary to consider surgery to both breasts and assess the need for reduction or mastopexy of the opposite breast together with revisional surgery on the previously reconstructed breast (Fig. 6.4). Patients who have had previous implant surgery before the use of tissue matrices often do not have well-defined inframammary folds. If the patient has sufficient skin inferiorly, then simply dividing the lower part of the capsule and placing a tissue matrix to define the inframammary fold and to provide a sling provides much enhanced lower pole projection and allows placement of a shaped prosthesis and can produce satisfactory results in many patients. Alternatively, autologous tissue transfer with or without lipofilling can be offered. Each patient requires careful assessment by the reconstructive team with sufficient time for the patient to consider all options.

### 6.9.1 Partial Breast Reconstruction

For patients who have significant degrees of asymmetry following breast-conserving surgery there are a range of options. If the treated breast is small but of satisfactory contour, then the simplest option is to perform a contralateral breast reduction and mastopexy. Most patients, however, have distortion at the wide excision site, often with displacement of the nipple. Lipofilling can improve distortion and contour, but the problem of nipple displacement remains. Following two or three episodes of lipofilling, it is possible to mobilise the skin of the breast and recentralise the nipple on the residual larger volume of breast mound. Where there is distortion, lipofilling usually needs to be combined with either scar release or open scar revision, excising the scar tissue at the wide excision site and reshaping the residual breast mound to get rid of the defect at the wide excision site. Placement of a prosthesis under the treated breast, or even in both breasts, has been used to good effect in carefully selected patients [58]. The implants can be placed underneath the breast or underneath the chest wall muscle. Although it was previously considered that implants in breasts treated by radiotherapy had a

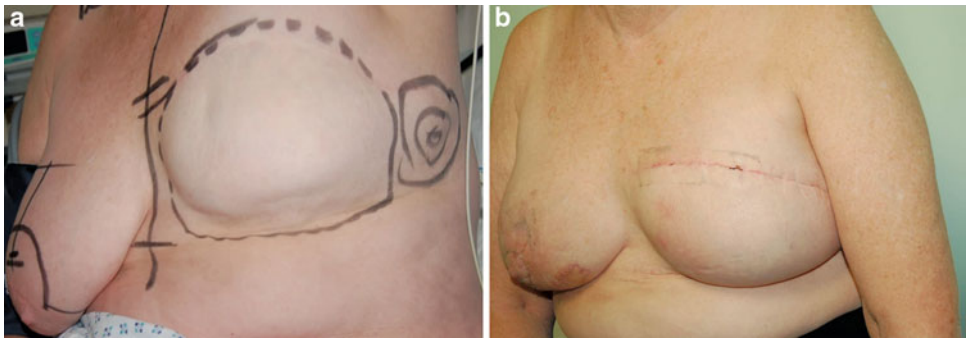


**Fig. 6.4** **a** Patient who had a left breast mastectomy with an implant 10 years earlier. Revision surgery involved placing Strattice® in the left breast to replace the prosthesis and doing a right mastopexy with a small reduction. **b** Result 2 weeks postoperatively

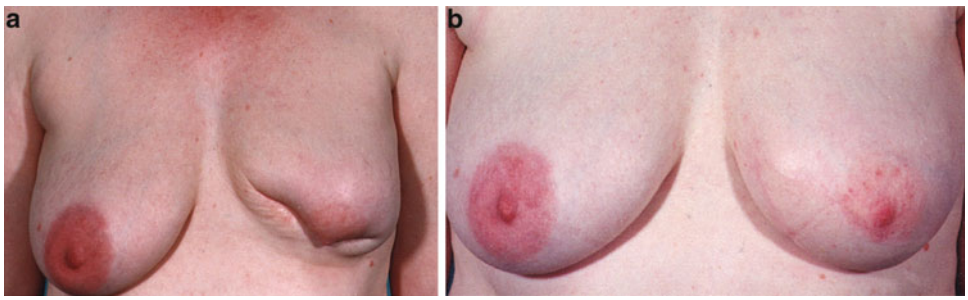


**Fig. 6.5** **a** Patient with a poor cosmetic result before and after LD flap partial reconstruction. **b** Postoperative result

high rate of capsular contraction and unsatisfactory cosmetic outcomes, in selected patients the results achieved have been excellent. However, with the recent improvement in the volumes of fat that can be harvested and with the increasing use of lipofilling, the number of patients who are either suitable for or require breast implants to gain satisfactory symmetry is small. In some patients there is a need to replace skin and volume, so the use of myocutaneous or even lipocutaneous flaps is the only option to obtain symmetry. The LD flap is the most widely used flap in this situation (Fig. 6.5).

When patients are attending consultations for consideration of procedures to achieve symmetry, then it is important to discuss all the appropriate and relevant options with the patient and give the patient time to come to an informed decision. Some patients with asymmetry attend consultations for advice on the best way to achieve symmetry when clothed. This can be achieved very effectively by wearing a shell over the treated breast in the bra rather than by more complex reconstructive surgical procedures. Provision of these shells increases women's confidence and their ability to wear a wider range of clothes. Surgery is thus not the only option for such women, and all such women should be given access to a properly trained prosthesis fitter and should be given advice by an appropriately trained reconstructive surgeon.

## 6.10 Reconstruction of One or Both Breasts

### 6.10.1 Bilateral Prophylactic Mastectomy in High-Risk Women

In the Mayo study of prophylactic mastectomy in high-risk women, 1,065 women underwent prophylactic mastectomy over 32 years [59]. Two-thirds were classified as having an increased breast cancer risk on the basis of their family history. The remainder had a variety of conditions, including breast pain, cystic disease and difficult mammograms. Ninety per cent had a subcutaneous mastectomy which was skin-sparing. In these patients, prophylactic mastectomy resulted in an over 90 % reduction in subsequent breast cancer development. Eighty per cent of the subcutaneous skin-sparing mastectomies were actually nipple-sparing. In this study of 425 low-risk women, ten deaths would have been expected from breast cancer, but none were observed, which is a 100 % risk reduction. In the 214 high-risk women, between 11 and 31 deaths from breast cancer were expected, whereas two occurred, which is an 81 94 % reduction in death rate.

Although nipple-sparing mastectomies are now widely used for prophylaxis, they can also be used in the treatment of women with invasive and in situ breast cancer. They

have an acceptable risk of recurrence of less than 2 % in T1 cancers [31, 60–62]. Selection of patients for nipple-sparing mastectomies has been based on the distance of the cancer from the nipple: the greater the distance, the less likely is nipple involvement of cancer. Where there are concerns there may be nipple involvement, this can be checked prior to surgery either by using a mammotome to remove the subareolar ducts [62] or by biopsying the ducts at the time of sentinel node biopsy prior to the mastectomy or during the operations by frozen section [63–66].

## 6.11 Timing of Breast Reconstruction

Immediate breast reconstruction is an increasingly appealing option offering women the option of waking up after their mastectomy with a reconstructed breast. This has obvious psychological advantages, and patients who request immediate reconstruction are usually pleased with this decision and the outcomes. Despite the psychological benefits of immediate reconstruction, there are some potential drawbacks, including being uncertain of the need for postoperative radiotherapy at the time the decision to choose the type of reconstruction is made.

Delayed reconstruction can be performed from several days to many years after mastectomy. Contrary to what some believe, many women do not become adjusted to breast loss. Some surgeons wait 3–6 months after mastectomy or 3–6 months after radiotherapy for the flaps to heal and for the skin reaction to settle. This allows time for seromas to resolve and for the patient to have time to consider the various options that may be suitable to reconstruct her breast. Results for both can be satisfying (Table 6.4).

There is a third way. In patients where it not clear whether they need radiotherapy or not, it is possible to place a tissue expander under the chest wall. The expander is inflated and this stretches the residual skin [64, 65]. If the patient does not need radiotherapy, there is the option of maintaining tissue expansion and replacing this with an implant later. For those who require radiotherapy, the expander can be reduced in volume to allow radiotherapy. A few weeks after completion of radiotherapy the expander is reinflated and 3 months later, the patient undergoes a further procedure usually bringing in vascularised tissue as an LD or abdominal flap. There is some evidence that the new tissue brought in rejuvenates skin which has been irradiated and results in an overall better result than doing a straightforward mastectomy, giving radiotherapy and then performing a standard delayed breast reconstruction.

**Table 6.4** Patient's rating of the results of their surgery at 18 months postoperatively

| Overall, how would you describe the results of your operation? | Mastectomy only | Immediate reconstruction | Delayed reconstruction |
|---|---|---|---|
| Excellent | 1,513 (36) | 520 (34) | 368 (47) |
| Very good | 1,565 (37) | 505 (33) | 242 (31) |
| Good | 786 (19) | 288 (19) | 101 (13) |
| Fair | 304 (7) | 145 (9) | 43 (5) |
| Poor | 74 (2) | 74 (5) | 28 (4) |

## 6.12 Patient Preferences and Breast Reconstruction

There are a variety of studies which have looked at patient preferences in relation to breast reconstruction. In one study 309 women who underwent a therapeutic mastectomy, 79 who underwent a prophylactic mastectomy and 247 women who had also undergone a breast reconstruction were asked to express opinions in relation to a number of options, including materials used for reconstruction, the number and duration of operations, short-term complication rate, long-term complication rate, aesthetic results and the time they might spend waiting for the operation [66]. In all 71 % agreed to participate in this study. Autologous tissue was preferred by these patients to implants, and shorter operations were preferred to longer operations. Patients wished for excellent results, with low rates of complications, but patients were willing to trade an excellent result for a good result for a 10 % reduction in short-term complications. On the basis of what women thought was important, an autologous LD flap with a good aesthetic result providing it only had a 10 % complication rate was the highest ranked option. Second was an autologous DIEP flap with a 10 % complication rate and a good result. Third was an autologous DIEP flap with an excellent result but a complication rate of up to a 25 %.

Patients select a reconstructive technique which suits their wishes after the initial discussion. Generally, simpler techniques which produce acceptable aesthetic results are preferred by most women, but more complex procedures generally give better results [3, 67] (Table 6.4). Interestingly, a study of female plastic surgeons found a strong desire for them to pursue implant-based reconstructions, with invasiveness of the procedure and recovery time cited as the most important reasons [68]. Patients' understanding of exactly what is involved in breast reconstructive surgery was investigated in one study where questions were asked in relation to the operation itself, the recognised complications and how breast reconstruction may influence the detection of recurrence. The study found that only 37.9 % of patients

answered the questions correctly [69]. Communicating options and providing informed choice is therefore a huge and ongoing problem [70].

Finally, body image and the impact of breast reconstruction change over time (see Fig. 6.3). Body image may initially be worse in patients who have had reconstruction but improves over time, and by 2 years it is as good as for patients who have had mastectomy or breast-conserving surgery [70]. Surgical issues even at 2 years may still be significantly greater in patients who have had reconstruction than in patients who have had breast-conserving surgery. Given the continued fall in local recurrence rates after breast-conserving surgery, the most important decision in breast reconstruction remains whether there are options to retain the patients own breast safely. However good a reconstruction is, it is rarely ever as good as a well-performed breast-conserving procedure.

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