

# Reconstructive Breast Surgery following Mastectomy for Breast Cancer: A Review

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## Abstract

**Breast cancer treatment has become increasingly less ‘invasive’ over the last several decades. There has been an increased detection and treatment rate due to the initiation of clear guidelines, screening programmes, and specialist centres offering a multi-disciplinary team approach. Breast conserving therapy remains the gold standard for surgical breast cancer treatment with the aim being to preserve shape and if possible size. However, many women either opt for or must undergo mastectomy, thus reconstruction surgery must be offered. This article provides a brief overview of various breast reconstruction techniques.**

**Keywords:** Breast reconstruction, breast cancer, implants, mastectomy.

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## Introduction

Breast cancer is the leading cause of cancer in women with almost 1.38 million new cases annually worldwide [1]. It accounts for 23% of all cancers and 14% of deaths from cancer [1]. One in nine women in the UK will develop breast cancer, however, the mortality rate is declining and now the 5-year survival rate is on the rise [2]. Surgery remains the mainstay of treatment for breast cancer and this can have a huge impact on aesthetics and body image. Breast reconstruction is a surgical procedure that aims to construct a breast that matches the contralateral breast in size, shape, and projection/contour. Despite not being able to re-create the exact look and feel of a natural breast, it is associated with improved body image, self-confidence and quality of life [3]. Breast reconstruction is essentially a ‘cosmetic’ procedure and therefore the patient’s anaesthetic demands need to be balanced with the surgical risks.

### *Invasive disease*

For women with invasive disease, surgical management may involve breast conserving surgery, mastectomy alone, or mastectomy with immediate or delayed breast reconstruction. In addition, axillary surgery is normally undertaken which involves the removal of some or all of the lymph nodes from the axilla in order to determine prognosis adjuvant therapy. Sentinel lymph node biopsy is used to remove the first few nodes draining the breast in order to assess spread. Various factors come into play when deciding which option is best, such as tumour size, type and location. In addition, these factors contribute in deciding the types of adjuvant therapies needed such as radiotherapy and chemotherapy. Radiotherapy may impair the cosmetic results of an immediate breast reconstruction thus is seen as a relative contraindication to immediate breast reconstruction. Chemotherapy is increasingly being used in women prior to mastectomy especially in those with large tumours.

### *Ductal carcinoma in situ*

For women with DCIS, surgical management may be the same as for invasive disease, i.e. breast conserving surgery, mastectomy alone, or mastectomy with immediate or delayed breast reconstruction. As DCIS may be more multifocal than invasive disease, a greater proportion of women with DCIS undergo mastectomy.

## Materials and Methods

### *Mastectomy*

The NICE guidelines recommend that immediate reconstruction should be discussed with and offered to all patients undergoing a mastectomy unless there is serious comorbidity [4]. In the UK, approximately 53% of women with breast cancer will undergo mastectomy (Table 1) [5]. In the UK, prophylactic bilateral mastectomies are increasingly being used to reduce the risk in women who are carriers of the BRCA1 and BRCA2 genes as this group of patients have an increased risk of developing breast cancer [6-8]. A simple mastectomy involves the removal of the breast skin envelope. In contrast, a skin-sparing mastectomy preserves the breast skin envelope (with or without the nipple). The latter is the technique of choice for immediate breast reconstruction as the aesthetic outcome is favourable [9]. Furthermore, the native nipple-areola complex (NAC) can also be preserved along with breast envelope preservation [10]. However, the nipple is affected in 5-31% of invasive or in situ breast cancers [11].

**Table 1:** Breast cancer undergo mastectomy.

Indications for mastectomy
- Large tumour size
- Multi-focal tumour
- Conservative management unsuccessful
- Patient choice
- Recurrence
- Patient not suitable for radiotherapy

### Immediate or delayed reconstruction

Breast reconstruction can be performed at the time of mastectomy (immediate) or at a later date (delayed). The main advantage of immediate reconstruction is preservation of both the native breast skin envelope and the inframammary fold, thus allowing for better aesthetics e.g. better ptosis. Another advantage of immediate reconstruction is that the emotional upset after the diagnosis of cancer and mastectomy is diminished, as well as preserving body image, femininity and sexuality [12]. However, immediate reconstruction can delay adjuvant therapy if post-operative complications occur. Furthermore, immediate breast reconstruction is associated with a higher complication rate than delayed reconstruction [13]. Further research is needed to provide reliable evidence for patients the best timing of breast reconstruction as there is no clear evidence supporting one over the other [14]. Patients who are uncertain about reconstruction are best advised to consider delayed reconstruction. Delayed reconstruction is for those who require cancer treatment and are unsure of which breast reconstruction option to choose. At the time of mastectomy, the native skin envelope is removed as patient has opted for delayed breast reconstruction. Therefore, extra skin must be recruited from a donor site or from skin expansion implants. The UK National Mastectomy and Breast Reconstruction Audit (NMBRA) evaluated nearly 17,000 women who underwent mastectomy 21% had immediate and 11% had delayed reconstruction [12]. Outcome questionnaires were completed at 3 and 18 months post-reconstruction which used a number of scales related to particular outcomes such as satisfaction with breast appearance, and physical, sexual and emotional well-being. The audit found that patients who chose delayed reconstruction had better satisfaction scores after reconstruction (Table 2) [12].

### Reconstruction options

There are various approaches to breast reconstruction. For many patients, no reconstruction is sought after and therefore a simple external prosthesis or padded is all that is required. For selected small tumours, a lumpectomy may be performed which means the opposite breast may need surgery to improve symmetry. The process of breast reconstruction can take up to 24 months and multiple surgical procedures are usually required to achieve the aesthetically-pleasing outcome. The choice of reconstruction also depends may other factors such as patient choice, co-morbidities (obesity, diabetes, smoking), tumour type, and post-operative therapy (radiotherapy). Radiotherapy after breast reconstruction can have unfavourable effects, such as tissue fibrosis and micro vascular changes, on the aesthetic outcomes.

Table 2: satisfaction scores after reconstruction.

	Immediate	Delayed
Visual satisfaction clothed	90%	93%
Visual satisfaction unclothed	59%	76%
Confident in social setting	85%	92%
Emotionally healthy	78%	88%
Breast tenderness	7%	4%
Sexual well-being	52%	60%

### Implant-based reconstruction

One option for breast reconstruction is implant-based reconstruction, which account for 61% and 37% of reconstructions in the US and UK, respectively [12-15]. Current options for implant-based reconstruction include immediate reconstruction with a definitive fixed volume implant, or a two-stage reconstruction process with a tissue expander followed by an implant. A tissue expander allows saline to be injected weekly until a desired volume is reached. In the UK, two types of implants are commonly used silicone gel implants or saline implants. The advantages and disadvantages of each are shown in Table 3. Implant-based reconstruction involves the use of an implant under the pectoralis major muscle (to reduce risk of capsular formation). To achieve complete coverage, a portion of the serratus anterior muscle can be raised laterally and sutured to the pectoralis muscle. Cellular dermal matrices are collagen sheets derived from human, bovine and porcine tissues and thus can be used instead of recruiting the serratus anterior muscle. In addition, benefits include: shorter operative time, fewer post-operative expansions required, larger initial volume implants can be used and lower rates of capsular contraction [16-18]. In addition, triple antibiotic irrigation has been shown to be associated with low clinical incidence of capsular contracture. Implant-based reconstruction is a relatively simple procedure with few complications (Table 3), but numerous visits may be required. Being foreign bodies, implants or expanders can suffer from problems such as infection, capsule formation or rupture however these complications can be reduced with sub-muscular positioning of the implant.

### Discussion

Autologous reconstruction: Reconstruction may also be performed using the patient's own tissue. There are two distinct ways in how this can be performed a pedicle flap or a free flap. A pedicle flap reconstruction involves rotating a flap comprised of skin, fat and usually muscle and with its blood supply, from the patients back (Latissimus Dorsi LD flaps) or abdomen (Transverse Rectus Abdominal Myocutaneous TRAM flaps) up into the breast area. Since the existing blood supply to the transferred tissue is maintained, this avoids the need for microsurgery. LD flaps are one of the most commonly used flaps for breast reconstruction in the UK [12]. This flap can be used on its own to reconstruct small breasts or it can be used in conjunction with implants in order to recreate anything other than small breasts. LD flap failure rate is 1%, however, the main disadvantage is a large donor scar and seromas are not uncommon (50-80%) (Table 4) [12]. In addition, patients may also experience shoulder pain, back pain, and difficulty lifting/carrying heavy objects [19]. A free flap reconstruction involves a flap being completely detached from the patient's own body (usually abdomen, buttock or thigh) along with its blood supply and is then placed at the mastectomy site using microsurgery. The longer operating times and greater anaesthetic risk means that it may not be suited to those with co-morbidities (obesity, diabetes, smoking) [21]. The abdomen is the main choice because a large enough volume of tissue is usually available as well as abdominal fat having a similar consistency to breast tissue. The two most common abdominal-based free flaps are

**Table 3: Advantages and disadvantages of silicone gel implants and saline implants.**

	Advantages	Disadvantages
<b>Silicone gel implants</b>	<ul style="list-style-type: none"> <li>- Less likely to wrinkle</li> <li>- Available in round or tear-drop shapes</li> <li>- Textured surface which can reduce excessive movement</li> <li>- Thick and firm so less likely to rupture</li> <li>- Soft, natural feel</li> </ul>	<ul style="list-style-type: none"> <li>- Expensive</li> <li>- Silent rupture</li> <li>- Slightly longer scars</li> </ul>
<b>Saline implants</b>	<ul style="list-style-type: none"> <li>- Similar to body fluids so can be safely absorbed if the implant ruptures</li> </ul>	<ul style="list-style-type: none"> <li>- May rupture</li> <li>- More prone to wrinkling</li> <li>- Typically available in only round shapes</li> </ul>

**Table 4: advantages and disadvantages of implant based and autologous reconstruction.**

	Advantages	Disadvantages
<b>Implant-based reconstruction</b>	<ul style="list-style-type: none"> <li>- Less invasive</li> <li>- No donor scar</li> <li>- Short operative time</li> <li>- Shorter recovery</li> </ul>	<ul style="list-style-type: none"> <li>- May require numerous tissue expansions</li> <li>- Infection</li> <li>- Capsule formation</li> <li>- Deflation</li> <li>- Extrusion</li> <li>- Rupture</li> <li>- Asymmetry/less ptosis</li> <li>- Changes in sensation</li> </ul>
<b>Autologous reconstruction</b>	<ul style="list-style-type: none"> <li>- Does not degrade</li> <li>- More natural look/feel</li> </ul>	<ul style="list-style-type: none"> <li>- Flap failure</li> <li>- Fat necrosis</li> <li>- Donor site scar</li> <li>- Long operative time</li> <li>- Longer recovery time</li> <li>- seromas</li> </ul>

TRAM and DIEP (Deep Inferior Epigastric Perforator) flaps. The TRAM flap involves the skin, subcutaneous fat and rectus abdominal muscle to be transferred from below the umbilicus (either as a pedicle or free flap). The major disadvantage of a TRAM flap is the loss of the rectus abdominus muscle, thus both pedicled and free TRAM flaps are associated with an increased risk of abdominal herniation, umbilical necrosis and the potential for flap failure [22]. DIEP flaps, a refinement of the free TRAM flap, preserve the entire rectus abdominus muscle and sheath since the only the skin and subcutaneous fat is transferred. This procedure results in less donor site morbidity, reduced post-operative pain and shorter hospital stay [23-24]. The main advantage of autologous reconstruction is that revision surgery is less likely as the transferred tissue adjusts to changes [19-20]. Several patients reported outcomes studies suggest that autologous tissue reconstruction provides greater long term satisfaction compared with implant-based reconstruction [19].

There are four main types of reconstruction:

- A tissue expander without the use of autologous tissue
- An implant (or expander) covered by a pedicle flap
- A pedicle flap without the use of an implant or expander
- A free flap

#### **Further reconstruction**

NAC reconstruction: Several studies have found that NAC reconstruction significantly improves patient satisfaction with breast reconstruction [25,26]. The ideal nipple reconstruction should be similar in symmetry, size, shape, texture and pigmentation. Nipple reconstruction is usually delayed for a few months after breast reconstruction. The nipple can be reconstructed using several techniques such as intra-dermal tattooing, local sub-dermal flaps, nipple sharing (grafting from contralateral breast) and nipple banking.

#### **Symmetrical procedures**

After breast reconstruction, the contralateral breast may need to be adjusted in order to create symmetry. This can be done in several ways such as mastopexy (breast lift), reduction mammoplasty, or breast augmentation.

#### **Lipomodelling**

It involves the transfer of autologous fat by blunt needle aspiration from a donor site (usually abdomen, hips, and thighs) to the breast. This procedure aims to improve breast shape and symmetry after breast reconstruction. Complications include infection, lipo-necrosis and calcification [27].

#### **Radiotherapy and chemotherapy radiotherapy**

It can affect implant- based or autologous reconstruction techniques and cause capsular contracture and flap contracture, respectively. In addition, it can cause loss of shape and volume [28-31]. Some institutions recommend against immediate reconstruction if radiotherapy is planned, thus a delayed reconstruction may be recommended. Neo-adjuvant or adjuvant chemotherapy does not significantly affect the long term outcome of breast reconstruction [32-33].

#### **Results and Conclusion**

Breast reconstruction is an important aspect of breast cancer management. Irrespective of timing, there are several techniques (implants, autologous tissue, or both) available from which the patient and surgeon can choose. Implant-based reconstruction is relatively simple and effective but not suitable for all patients, particularly those who have had or require radiotherapy. In contrast, autologous reconstruction yield better aesthetically-pleasing results despite being more surgically demanding.

#### **Conflict of Interest**

The author declares no conflict of interest

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