# 6 Plastic and Reconstructive Breast Surgery

An estimated 1.7 million women worldwide will be diagnosed with invasive breast cancer in 2018. Alongside these new diagnoses, there will be a corresponding increase in annual rates of breast reconstruction. The latter offers well-documented benefits in terms of body image, quality of life, and high patient satisfaction, irrespective of whether this follows mastectomy or breast conservation. This is attributable to advances in surgical techniques and a multitude of surgical options for women seeking breast reconstruction after either mastectomy or lumpectomy.

## 6.1 Surgical Planning and Incisions for Mastectomy

When planning a mastectomy, one of the most important initial decisions to be made is whether nipple-areola complex (NAC) preservation will be undertaken (nipple-sparing mastectomy). In general, this decision is made both on grounds of oncologic safety and aesthetic benefit. If preoperative imaging reveals no direct involvement of the nipple with tumor, there is a high probability that nipple-areola preservation is feasible. Once this is confirmed by the surgical oncologist, and the plan is to remove nipple parenchyma but preserve nipple skin, then the incision location must be planned for a nipple-sparing mastectomy (NSM).

Multiple incisional approaches are possible for NSM (Fig. 6.1). The most commonly used incisions are inframammary and radial. The inframammary incision is generally used for smaller breasts with no evidence of preoperative ptosis. Conversely, a radial incision can also be used in these situations, should there be a need for more central access to the breast parenchyma.

For those cases in which there is grade 2 preoperative ptosis of the breasts and there is a desire to correct this by incorporating a mastopexy into the incision for the NSM, then a crescent mastopexy-type pattern can be used. This can excise superior areolar skin and elevate the NAC, correcting up to 2 cm of ptosis. When this design of incision is employed, it is important that the portion of the incision along the superior areolar border be less than 25% of the overall areolar circumference, in order to preserve perfusion of the NAC.

It is particularly important that the correct location for the incision be planned to allow for comprehensive access to all areas of glandular tissue and thereby perform a thorough mastectomy. However, positioning of the incision also has important implications for aesthetic outcomes of the reconstructed breast. To this end, the location of the incision should be planned jointly by the surgical oncologist and plastic surgeon.

## 6.2 Breast Reconstruction Options

Following mastectomy, breast reconstruction can be done at the time of mastectomy (immediate breast reconstruction), or at any time after mastectomy (delayed breast reconstruction). In recent years, immediate breast reconstruction has gained wider acceptance. Breast reconstruction can be performed using either prostheses or autogenous tissue in the immediate or delayed setting.

There are several options available for those patients choosing prostheses. A permanent prosthesis can be placed at the time of mastectomy, if there is sufficient viable skin to support coverage of the desired size of implant. Alternatively, a tissue expander can be placed surgically and inflated gradually over a period of several weeks in the outpatient setting by injecting saline through a port. This results in creation of a breast skin mound with ptosis, and a typical teardrop shape comes from temporary overexpansion. At a second operation, the tissue expander is then removed and replaced with a permanent prosthesis.

For those patients choosing breast reconstruction with autologous tissue, the three most common options are the latissimus dorsi flap, the transverse rectus abdominus myo-

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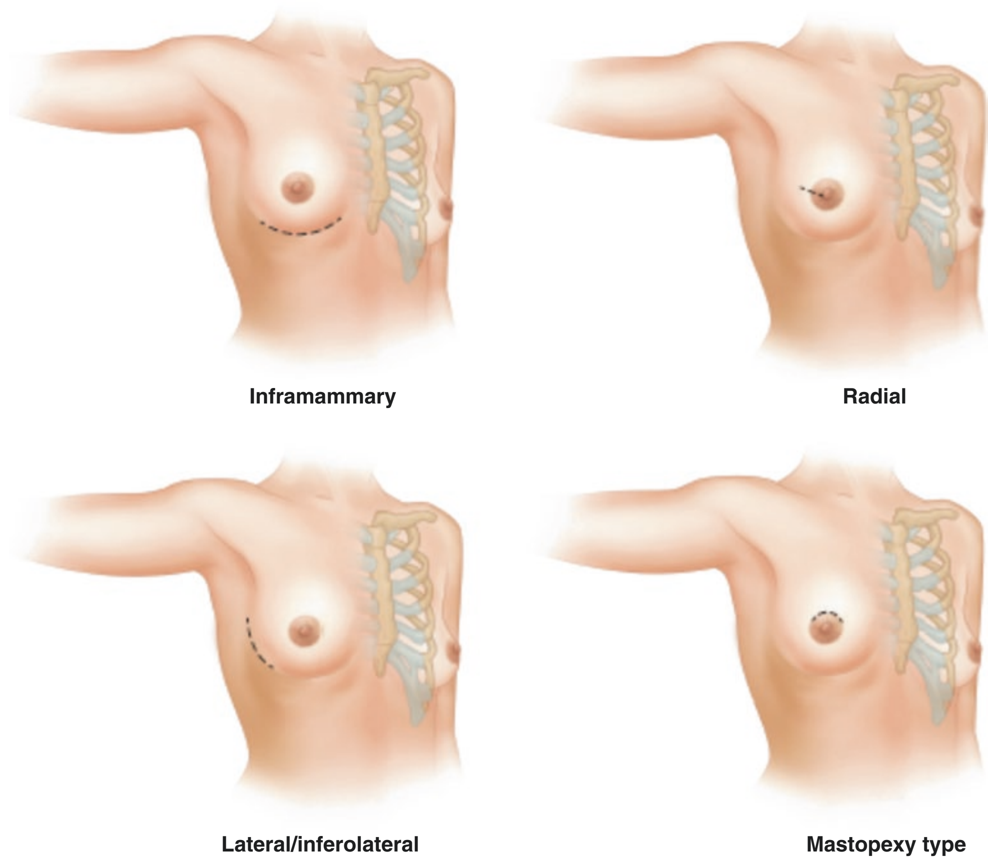



**Fig. 6.1** Examples of the various incisional approaches most commonly used for nipple-sparing mastectomy

cutaneous (TRAM) flap, or the deep inferior epigastric perforator (DIEP) flap. The latissimus dorsi muscle flap alone usually does not provide enough tissue bulk, and therefore a permanent prosthesis is often placed beneath the flap – an implant-assisted latissimus dorsi flap reconstruction. However, a totally autologous technique for latissimus dorsi flap reconstruction promoted by Emmanuel Delay in France provides satisfactory results in selected patients without the need for placement of an implant.

In contrast, the TRAM flap provides considerable tissue bulk in appropriate patients; a prosthesis is not required in most cases. The TRAM flap is technically a more difficult surgical procedure and carries a greater risk of complications. Several different TRAM flap techniques have been developed, including pedicled and free flap variants that require the use of microvascular procedures. The main drawback of a standard TRAM flap is harvesting the full width of rectus abdominis muscle together with the overlying subcutaneous tissue. This is necessary to carry the blood supply (inferior epigastric vessels) and maintain viability of the tissue. For this reason, the deep inferior epigastric perforator (DIEP) flap was developed in the submuscular pocket. With this technique, the same area of infraumbilical abdominal tissue is harvested, but with careful dissection and isolation of vascular perforators that pass from the inferior epigastric vessels through the muscle fibers. These vascular perforators can then be taken and used for anastomosis without the need to sacrifice the rectus abdominis muscle. The DIEP flap is taken as a microvascular free flap with the perforator vessels anastomosed to blood vessels in the chest (usually internal mammary vessels). This revascularizes the flap prior to use in reconstruction of the breast.

## 6.3 Prosthetic Breast Reconstruction

Following mastectomy, implant-based procedures are the most commonly performed reconstructive option. Either with a traditional two-stage approach using tissue expansion or via a single-stage (direct to implant) approach, these techniques produce highly aesthetic outcomes with a multitude of breast sizes.

Immediate placement of a tissue expander or permanent implant at the time of mastectomy is preferable and takes advantage of the natural shape of the breast skin envelope to achieve an improved aesthetic outcome. However, delayed breast reconstruction following previous mastectomy is another option and frequently performed. Tissue expanders and implants, when used for postmastectomy reconstruction, can be placed in different anatomic planes: fully submuscular (underneath pectoralis major muscle and serratus anterior muscle or fascia), dual-plane (under a combination of pectoralis major muscle and acellular dermal matrix (ADM)), or pre-pectoral (completely covered with acellular dermal matrix).

With submuscular reconstruction a pocket is created for coverage of a definitive prosthesis comprising the pectoralis major and serratus anterior muscles. The tissue expander is placed in the muscular pocket, and the catheter and port are tunneled subcutaneously to a position deep to the skin in the axilla or inframammary region (Fig. 6.2). In cases of staged reconstruction, there is placement of an expander with the fill port located on the surface of the expander (Fig. 6.3). Postoperatively, a magnetic device can be employed to help localize the port and thereby facilitate inflation.

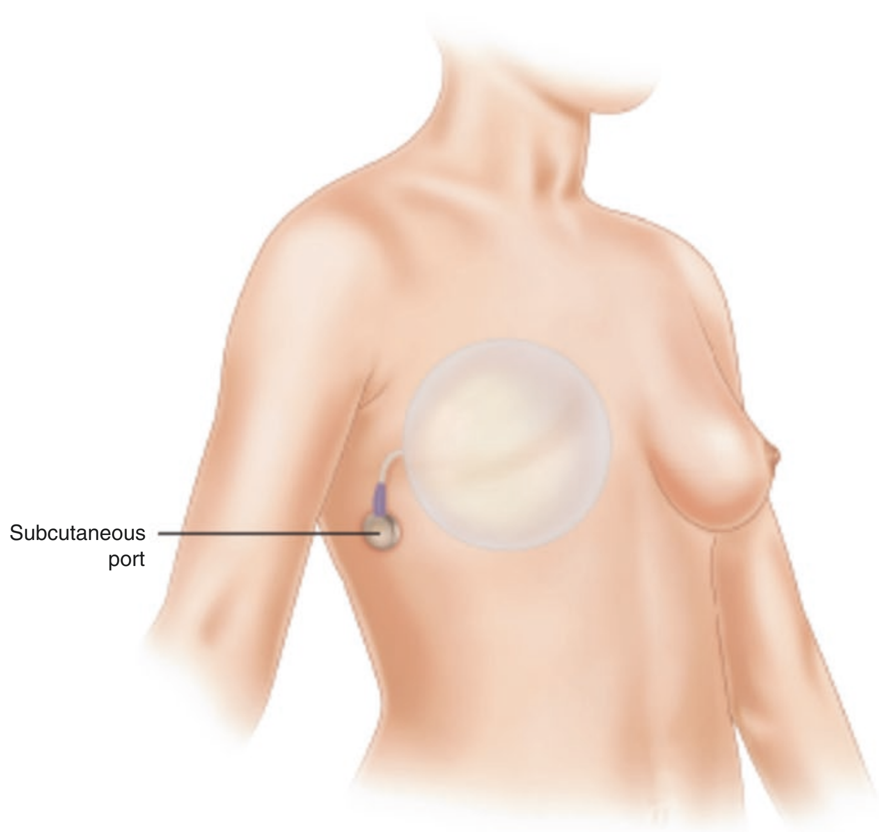
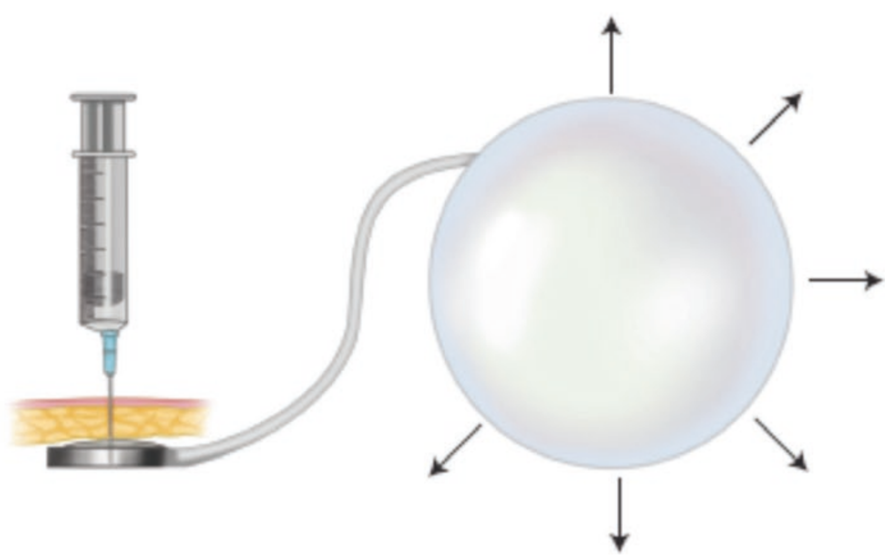



**Fig. 6.2** Breast reconstruction with expander



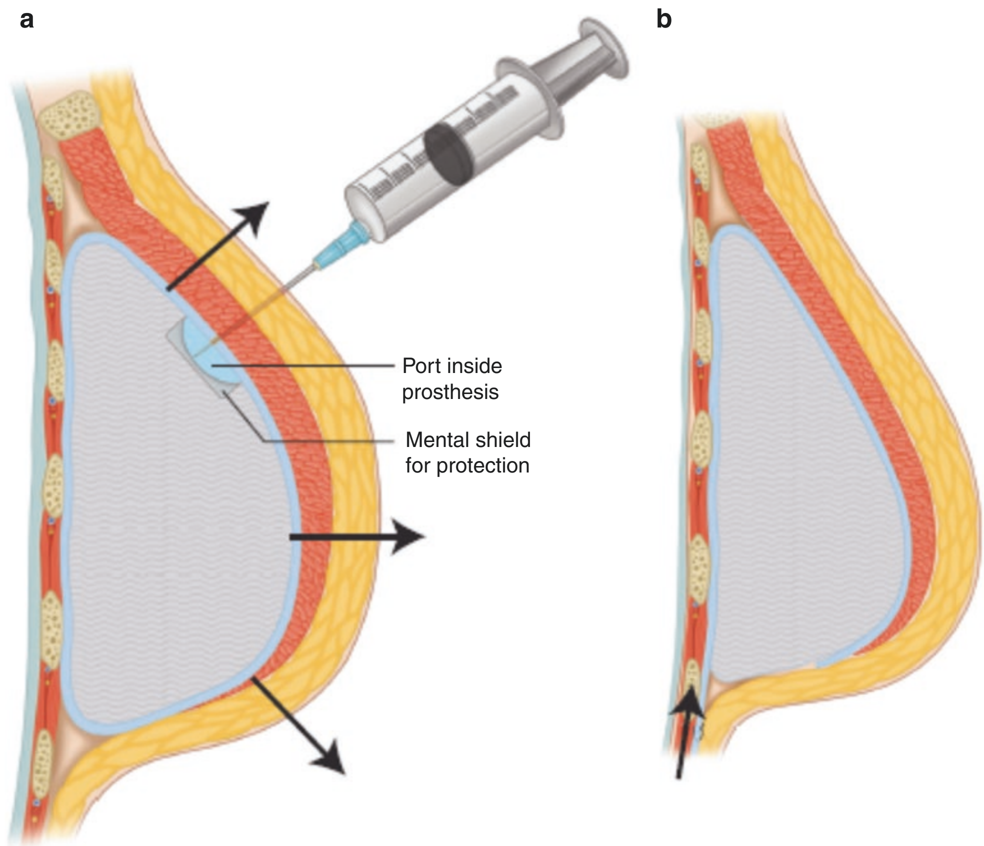



**Fig. 6.3** (**a**) Cutaneous expander. (**b**) Position of the definitive prosthesis. After definitive substitution with a definitive prosthesis, the same stitches in the sulcus improve the natural ptosis

The expander is inflated by passing a 22 gauge needle into the port and injecting saline solution through it. This is done once or twice per week until the expander is inflated sufficiently such that the nipple projection lies at the same level bilaterally and the correct size of breast has been achieved. This will provide a degree of ptosis. After a suitable period of expansion, the tissue expander is replaced by a permanent prosthesis at a second operation.

Figures 6.2 and 6.3a, b illustrate the principle of cutaneous expansion, which is necessary to obtain a degree of ptosis. The latter is achieved by gradual inflation of the prosthesis by injecting saline solution through the port once or twice each week over a period of several weeks.

Traditional submuscular techniques have been employed most frequently to obtain soft tissue coverage of both tissue expanders and implants and are reliant on the pectoralis major and serratus anterior muscles and fascia. In recent years, there has been a shift in technique with utilization of ADM as an adjunctive material for soft tissue coverage, thus avoiding the need for muscle elevation to the same degree. ADMs represent a special type of biologic mesh, consisting of a sheet of collagen scaffold that can integrate and revascularize from the patient's own surrounding tissue after surgery. They most commonly are derived from either human or porcine tissue.

Initial applications of ADM involved elevating and inferiorly disinserting the pectoralis major muscle effectively using ADM as an inferior extension of the pectoralis major. In this manner, the ADM covers the lower portion of the prosthesis and is sewn onto the chest wall along the lower border of the prosthesis, at the site of the desired inframammary fold (Fig. 6.4). This allows for a greater in-fill volume to the pocket, and thus a greater intraoperative volume is possible (whether tissue expander or implant). This also improves appearance of the reconstructed breast due to precise placement of the inframammary fold by suturing of the ADM directly to the chest wall (Fig. 6.5).

More recently, ADM has been used to a greater extent in pre-pectoral breast reconstruction. With this technique, no muscle elevation is performed to create a pocket for the prosthesis. Instead, ADM is used to cover the entire prosthesis (Fig. 6.6), and this represents a fully muscle-preserving prosthetic breast reconstruction. This technique is restricted to those patients with well-vascularized mastectomy skin flaps as this is required to revascularize the relatively large sheet of ADM and thereby permit successful breast reconstruction.

Both of these techniques utilizing ADM can be performed for either single-stage permanent implant coverage, or tissue expander coverage at the time of mastectomy. The technique is selected based on preoperative breast size, desired reconstructed breast size, size and dimensions of the native breasts, as well as clinical vascularity of the skin flaps following completion of mastectomy.

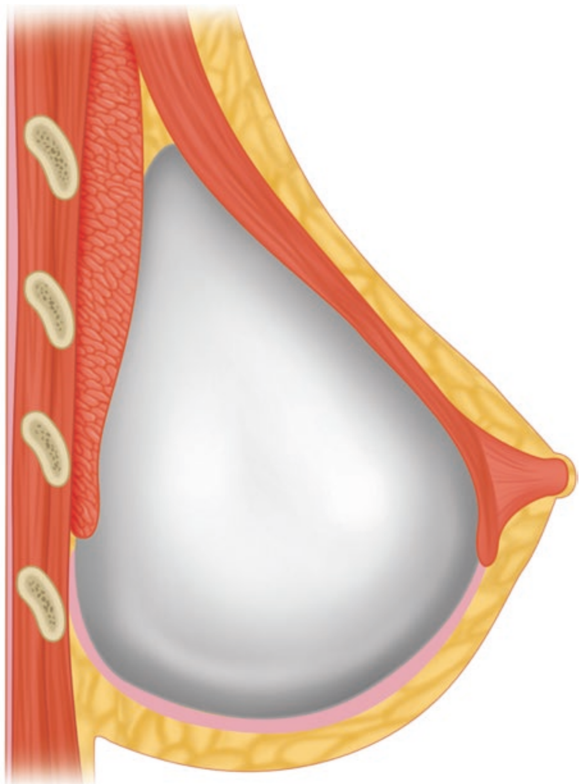


Fig. 6.4 Partial subpectoral/partial ADM coverage of an implant on cross-section, showing the combination of tissue coverage used for the prosthesis

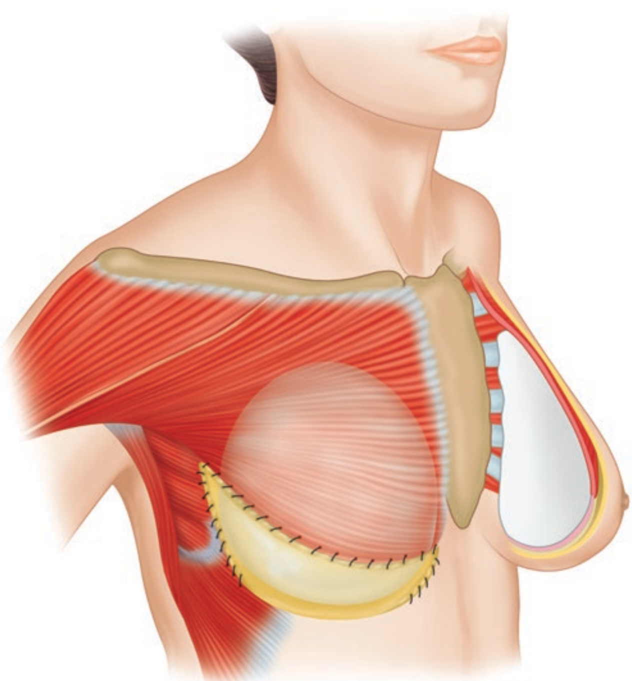


Fig. 6.5 Partial subpectoral/partial ADM coverage of an implant on frontal view, showing the ability of the ADM to act as an inferior extension of the dis-inserted pectoralis major muscle

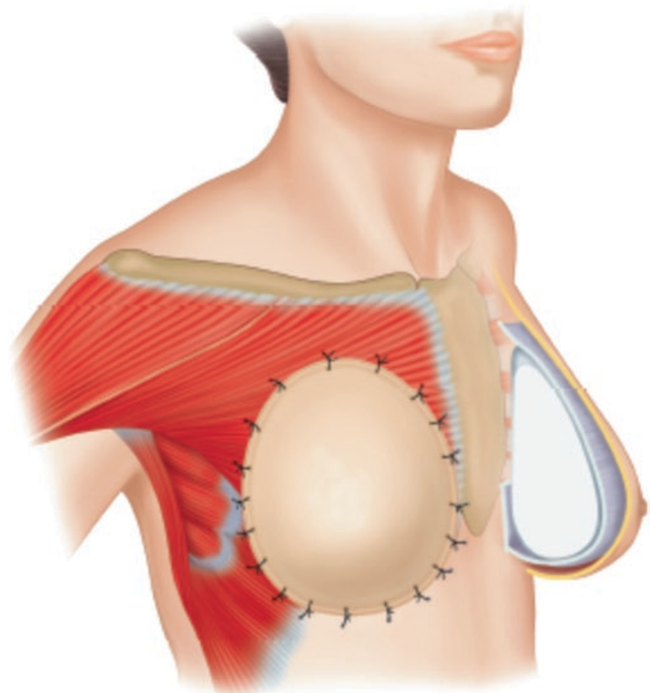


Fig. 6.6 Pre-pectoral breast reconstruction, showing complete soft tissue coverage of the prosthesis with ADM; thus, there is no need for muscle elevation, and this reconstruction is fully muscle preserving

The major benefits of prosthetic breast reconstruction are a patient's ability to choose the size of their reconstructed breasts, rapid postoperative recovery, and prompt return to normal activities from avoidance of transposing tissues from other parts of the body and concomitant donor site morbidity.

## 6.4 Pre-pectoral Breast Reconstruction

Traditionally, prosthetic breast reconstruction following mastectomy involves placing a tissue expander or permanent implant beneath not only the breast skin envelope but also the pectoralis major muscle. Coverage can be assisted by incorporating the serratus anterior muscle or fascia or more recently by use of ADM as additional material. Submuscular placement of prosthetic devices is based on the premise that this is associated with lower rates of capsular contracture compared to subcutaneous placement.

For many years, this submuscular approach has been the dominant technique for postmastectomy breast reconstruction. However in recent years and following the advent of ADM, there has been a dramatic increase in the numbers of pre-pectoral breast reconstruction being performed. This method avoids any dissection or elevation of the pectoralis or serratus muscles and instead uses ADM exclusively for soft tissue coverage of expander or implant which is placed anterior to the pectoralis major muscle.

This pre-pectoral approach has led to several important benefits for patients, including reduced levels of pain and elimination of animation deformity. Furthermore, absence of the pectoralis major muscle in the reconstructive process has allowed women to experience enhanced aesthetic definition of the reconstructed breast (implant positioning is no longer inhibited by pectoralis muscle anatomy). Moreover, they do not suffer any loss of upper body strength as a consequence of full muscle preservation.

The outcomes of pre-pectoral breast reconstruction using ADM for soft tissue coverage and support have been shown to be equivalent to those of subpectoral reconstruction. These observations also apply in the setting of postmastectomy radiation therapy. Many of the initial concerns surrounding this procedure were due to the increased risk of rippling and upper pole aesthetic deformities due to absence of the pectoralis major muscle covering the upper pole of the implant. However, use of cohesive gel implants together with autologous fat grafting for volume restoration has lessened such concerns. These advances in breast reconstruction have eliminated the need to sacrifice the pectoralis major muscle for purposes of improving upper pole aesthetic outcome. As a consequence, the frequency of pre-pectoral reconstruction techniques is rapidly growing in popularity in the United States. When planning a pre-pectoral implant-based breast reconstruction, the surgeon must bear in mind certain contraindications. This technique should be reserved for patients with viable and well-perfused mastectomy skin flaps. Thin skin flaps can be suitable for these tissue expander-based pre-pectoral breast reconstructions provided they are healthy and well perfused. Furthermore, these techniques should not be promoted in patients with uncontrolled diabetes and active smoking habits or in patients who are morbidly obese. From the oncologic perspective, contraindications to pre-pectoral reconstruction include those patients with deeply situated breast tumors that reach within 0.5 cm of the chest wall and cases of inflammatory breast cancer. All the aforementioned factors should be considered when planning this type of breast reconstruction.

## 6.5 Hypothesis to Explain Capsular Contracture

Fibroblasts within the tissue in contact with the prosthesis will migrate to the zone immediately around breast implants and expanders following surgical placement. These special fibroblasts, known as myofibroblasts, are responsible for depositing an envelope of scar tissue around the device (otherwise known as a capsule) and are directly responsible for any subsequent capsular contracture. After healing of the surgical wound, myofibroblasts generally disappear in the majority of patients. However, these cells may persist within capsules that have formed around breast prostheses, and this might offer an explanation for the mechanism of capsular contracture

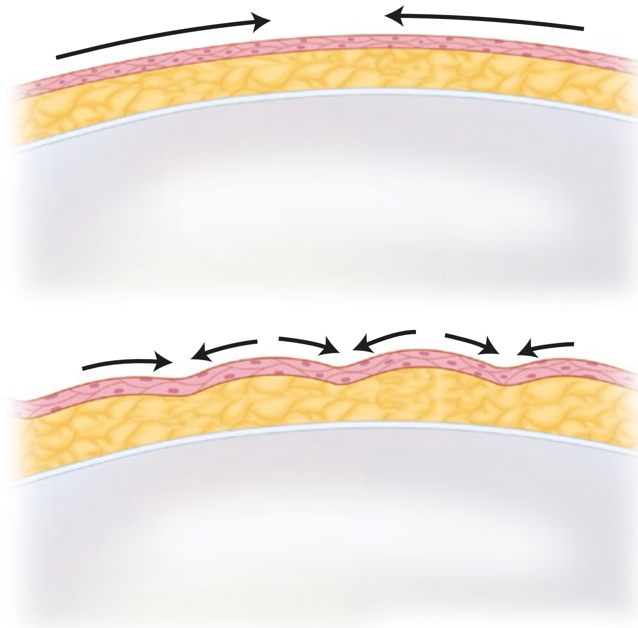


**Fig. 6.7** A hypothesis to explain capsular contracture

As shown in the accompanying illustrations, when an implant is placed on the chest wall in breast reconstruction, it becomes lined with contractile fibroblasts (Fig. 6.7) and the implant can thus be viewed as a three-dimensional wound. These contractile fibroblasts are responsible for an initial phase of contracture, but counter pressure from the implant tends to prevent further contracture. Firmer implants should therefore be less prone to capsular contracture than softer implants.

Any process that results in increased inflammation within the breast pocket can lead to hyperactivity of fibroblasts and resultant capsular contracture. Thus, infection (biofilm) and hematoma have been implicated in higher rates of capsular contracture.

Capsular contracture is graded on clinical criteria, based on examination findings, and is defined using the Baker classification scale (Fig. 6.8).

## 6.6 Suspension Technique (Advancement Abdominal Flap)

When a permanent prosthesis is to be inserted following mastectomy and definition of the previous inframammary fold has been lost, the cosmetic appearance can potentially be improved using the "suspension technique." First, a wide area of abdominal tissue is undermined inferiorly, along the anterior surface of the rectus abdominis muscle (Fig. 6.9a). In this manner, the skin and subcutaneous tissue along the inferior aspect of the mastectomy wound are mobilized. The head of the operating table should then be raised, placing the patient in a semi-upright position. The abdominal flap that has been mobilized is then pulled up and maintained with a triangular nonabsorbable mesh that is fixed at the level of the future inframammary fold. The mesh is brought up superiorly, posterior to the pectoralis major muscle (Figs. 6.9b and 6.10), and the superior aspect of the mesh is attached to the costal cartilage with two nonabsorbable stitches (3–0 Prolene) as illustrated (Fig. 6.9b). The prosthesis is then placed anterior to the mesh and posterior to the pectoralis muscle as shown (Fig. 6.10). This "suspension technique" is a form of abdominal flap advancement and was first described by Rietjens in 1977.

| | | |
|---|---|---|
| Grade I | No palpable capsule | The augmented breast feels as soft as an unoperated one. |
| Grade II | Minimal firmness | The breast is less soft and the implant can be palpated, but is not visible. |
| Grade III | Moderate firmness | The breast is harder, the implant can be palpated easily, and it (or distortion from it) can be seen. |
| Grade IV | Severe contracture | The breast is harder, tender, painful and cold. Distortion is often marked. |

**Fig. 6.8** Baker classification system for grading capsular contracture

## 6.7 Breast Reconstruction in the Setting of Post-mastectomy Radiation

Breast reconstruction in the setting of post-mastectomy radiotherapy (PMRT) presents a particular challenge and is associated with higher rates of incisional dehiscence, infection, and capsular contracture. Reported rates of overall complications in this setting range from 15% to 40% with some centers not infrequently experiencing complication rates of 30–40% following irradiation of a reconstructed breast.

When planning prosthetic reconstruction in the context of PMRT, the surgeon must first decide whether radiation will be delivered to a tissue expander or permanent implant. Reported rates of infection are lower with irradiation of permanent implants, since all operations on the breast have to be undertaken prior to radiation. However, rates of capsular contracture are higher for this option with the irradiated

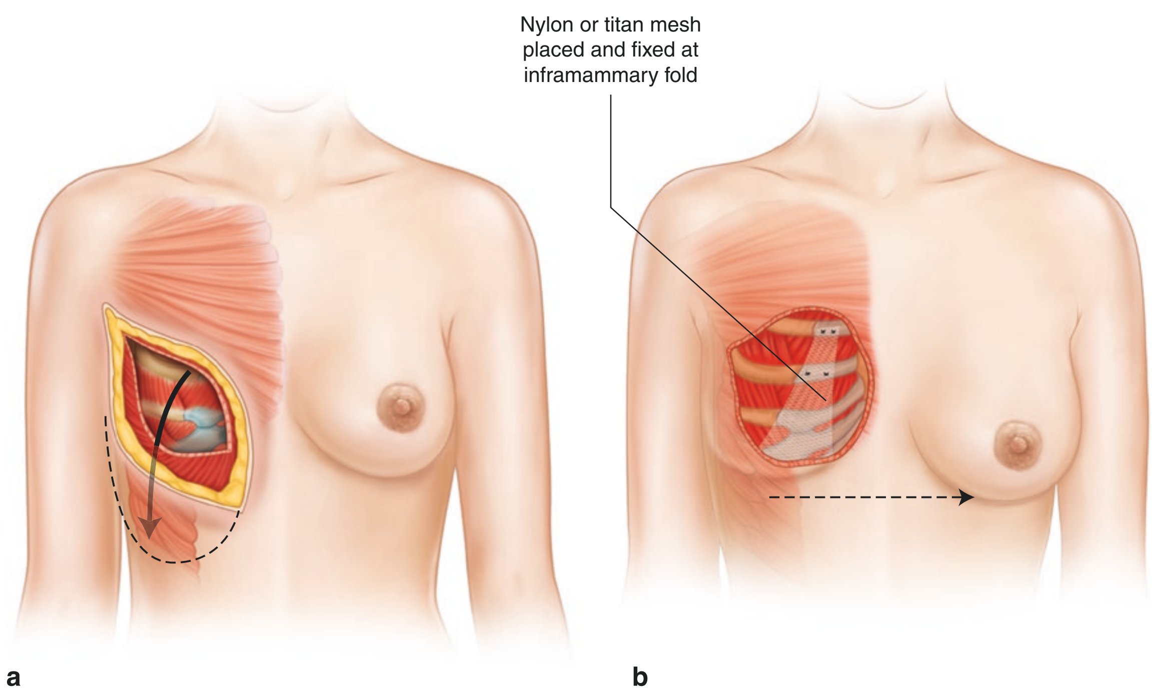



**Fig. 6.9** (**a**, **b**) Immediate breast reconstruction, using the "suspension technique II"

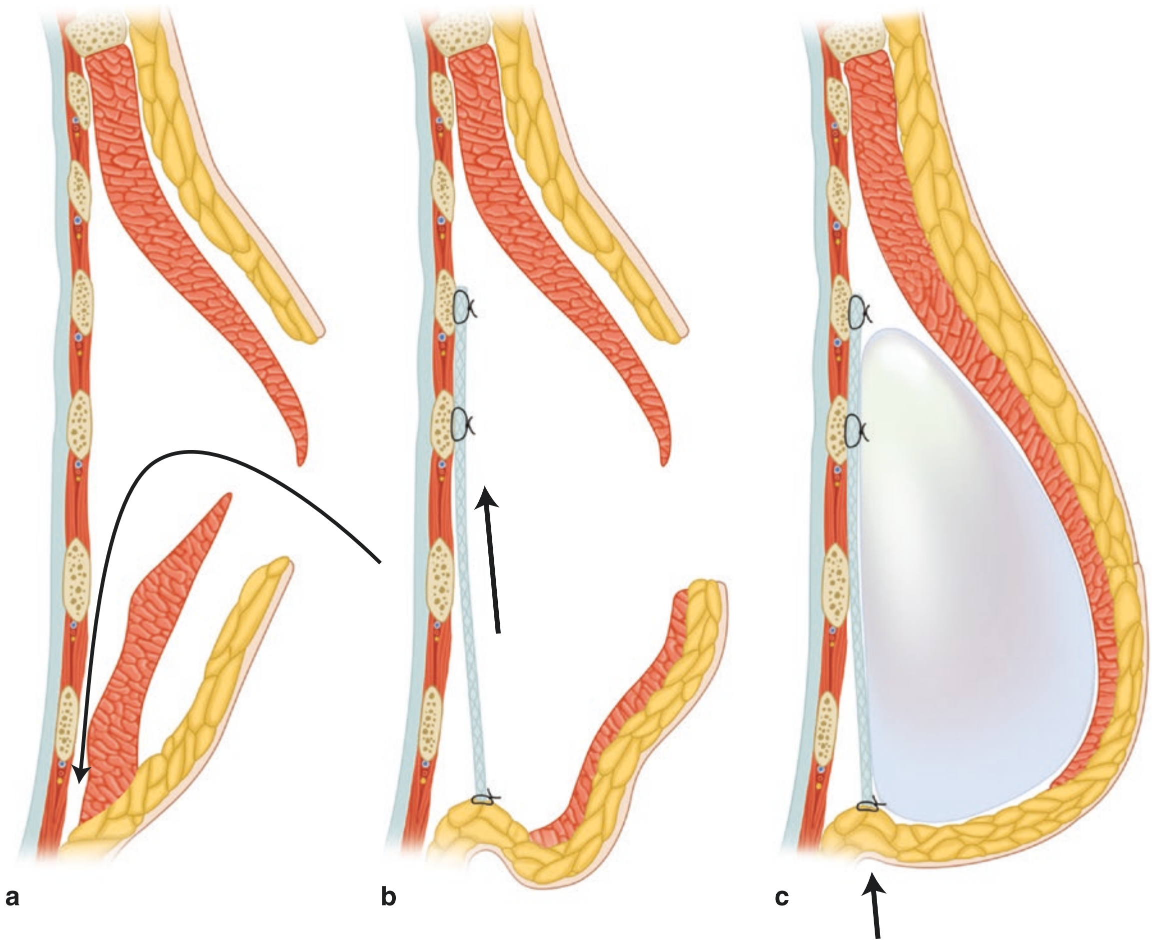



**Fig. 6.10** (**a**) Immediate breast reconstruction using the "suspension technique" (profile view). (**b**) With mesh. (**c**) Suspension technique with mesh and subpectoral prosthesis

implant remaining in situ permanently, without the option for capsulectomy after completion of radiation. Delivery of radiation to tissue expanders allows the opportunity for capsulectomy and contracture reduction with correction of any displacement or deformity that has occurred during radiation. For this reason, irradiation of tissue expanders is the most common approach in the setting of PMRT.

Even when radiation delivery to a permanent implant is preferred, many patients undergoing two-stage reconstruction will not be suitable candidates as radiation therapy begins around 4 weeks after mastectomy. This timeline will not allow for the second-stage expander to implant exchange to be performed prior to radiation delivery.

Given these risks and constraints, many strategies have been developed to reduce complication rates following mastectomy and prosthetic reconstruction in the setting of PMRT. This is especially relevant with increasing frequency of NSM. In this group of patients, radiation increases rates of skin necrosis and infection, but not necessarily rates of nipple necrosis relative to non-irradiated breasts. Therefore NSM can be safely performed when PMRT is anticipated.

Location of the incision has been shown to be critical in terms of complication rates in the setting of PMRT. A periareolar, radial, or any other incision on the anterior aspect of the breast is associated with lower complication rates compared with an inframammary fold incision when radiation follows surgery. Regardless of incision type used for NSM and immediate tissue expander placement, the second-stage exchange operation for a permanent implant after radiation treatment should always be performed through a different incision. The original incision consists of scar tissue that has been significantly devascularized by irradiation. Instead, a new incision should be planned in an area without scars from previous surgery. This strategy will significantly reduce wound dehiscence rates following PMRT.

Another important consideration is the time interval between completing radiation and the second-stage expander to implant exchange operation. While there remains no absolute consensus on this, there is data to suggest that waiting at least 6 months after radiation completion will significantly reduce complication rates from the second operation. This will allow the acute effects of radiation fibrosis to dissipate, including the acute inflammatory changes in the skin envelope that allows for improved healing. During this time period, many surgeons will perform autologous fat grafting on the acutely irradiated breast skin as this procedure has been shown to reduce some of the damaging effects of radiation fibrosis.

The widespread use of ADM in breast reconstruction has helped reduce complication rates in the setting of PMRT. Multiple centers have published similar findings confirming that prosthetic implants with ADM coverage are associated with significantly lower rates of complications overall (including implant extrusion) relative to full submuscular coverage. Thus, the use of ADM to support and cover prosthetic implants when radiation treatment is indicated or anticipated should be encouraged. Other benefits of ADM include greater control over the aesthetic boundaries of the reconstructed breast, less implant movement, and reduced rates of capsular contracture.

The use of autologous tissue for breast reconstruction in the setting of radiation results in lower rates of infection due to the vascularized nature of these tissue-based reconstructions. However, certain considerations are of paramount importance in these patients, and radiation of autologous flaps results in higher rates of fat necrosis and partial flap loss. For these reasons, many centers delay autologous flap reconstruction until after completion of radiation and instead proceed with placement of a temporary tissue expander at time of mastectomy which serves to maintain the shape of the skin envelope (so-called delayed-immediate reconstruction).

Nonetheless, some specialized breast reconstruction centers have performed immediate autologous reconstruction followed by radiation of flaps with consistently high levels of success. In their experience, rates of revisional surgery to manage PMRT-induced complications are the same as for non-irradiated flaps. These outcomes give merit to performing definitive reconstruction as a single operation prior to radiation treatment. It has also been found that those flaps with enhanced perforator blood supply, namely, muscle-sparing TRAM (msTRAM), have lower complications and better outcomes when irradiated compared with relatively poorly perfused single or double perforator (DIEP) flaps. Thus, msTRAM flaps are preferred when radiation is anticipated in this reconstructive setting.

For those patients undergoing microsurgical autologous tissue reconstruction following radiation, the more common scenario of waiting longer periods of time after completion of radiation will improve free flap outcomes. This allows for recovery over time of the internal mammary or thoracodorsal vessels from the damaging effects of radiation which in turn will lead to improved anastomotic patency and vascularity. Studies suggest that waiting 1 year after completion of radiation before undertaking microvascular breast reconstruction results in significantly reduced rates of total flap loss compared to proceeding with surgery within 1 year.

Regardless of the exact procedure planned, both pedicled and autologous flap-based reconstructions have excellent outcomes in the setting of radiation treatment. The vascularized autologous nature of these flaps renders them well-suited to resisting the damaging effects of radiation and specifically to minimize infection rates.

## 6.8 Latissimus Dorsi Flap

In recent years, there has been a decline in the use of latissimus dorsi flaps for breast reconstruction with the advent of ADM. However, this remains an acceptable choice for autologous reconstruction either as a totally autologous technique or in combination with a tissue expander or implant.

When a latissimus dorsi flap is selected as the method for breast reconstruction, preoperative planning is critical in terms of marking of the shape and extent of the donor site skin to be taken with the muscle as part of a myocutaneous flap. The surgeon should outline the site of the planned mastectomy skin incision or estimate the amount of skin to be imported onto the chest wall to replace thin, devascularized, or radiation-damaged skin. This incision pattern is outlined on paper, which is then used as a template to outline the skin over the latissimus dorsi muscle. The accompanying illustration depicts possible locations of the skin paddle overlying the muscle that might be used in a latissimus dorsi flap reconstruction (Fig. 6.11). The more elliptical the skin

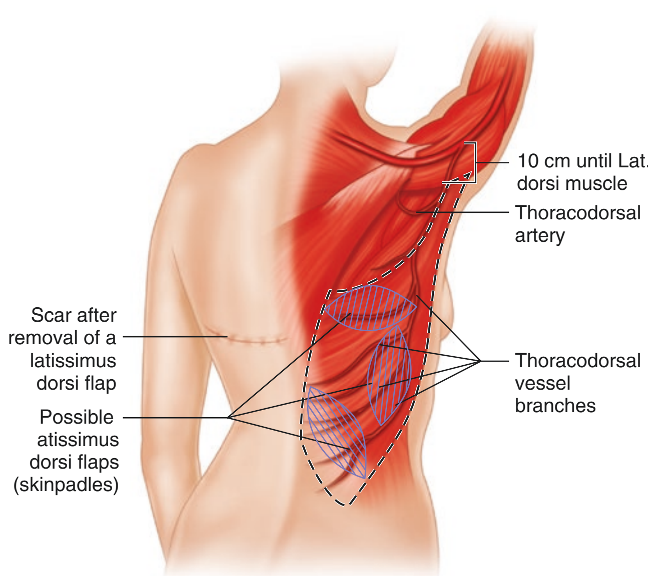



**Fig. 6.11** Breast reconstruction with latissimus dorsi flap, blood supply, and possible skin paddles

incision, the easier it is to close (maximum width should not exceed 10 cm).

The latissimus dorsi flap is comprised of a skin paddle and underlying fat and muscle (Fig. 6.12). When the flap is used for immediate breast reconstruction, the mastectomy component must be completed before beginning the reconstruction. The mastectomy wound is packed with moist laparotomy pads and isolated with an Ioban drape. The patient is then turned on her side and placed in the lateral decubitus position, providing the surgeon with easy access to the latissimus dorsi muscle and surrounding tissues. The patient's position on the operating room table is secured with a beanbag, and an arm/shoulder support is essential to prevent traction on the brachial plexus.

An elliptical or small circular incision is made (corresponding to the mastectomy incision) for skin replacement.

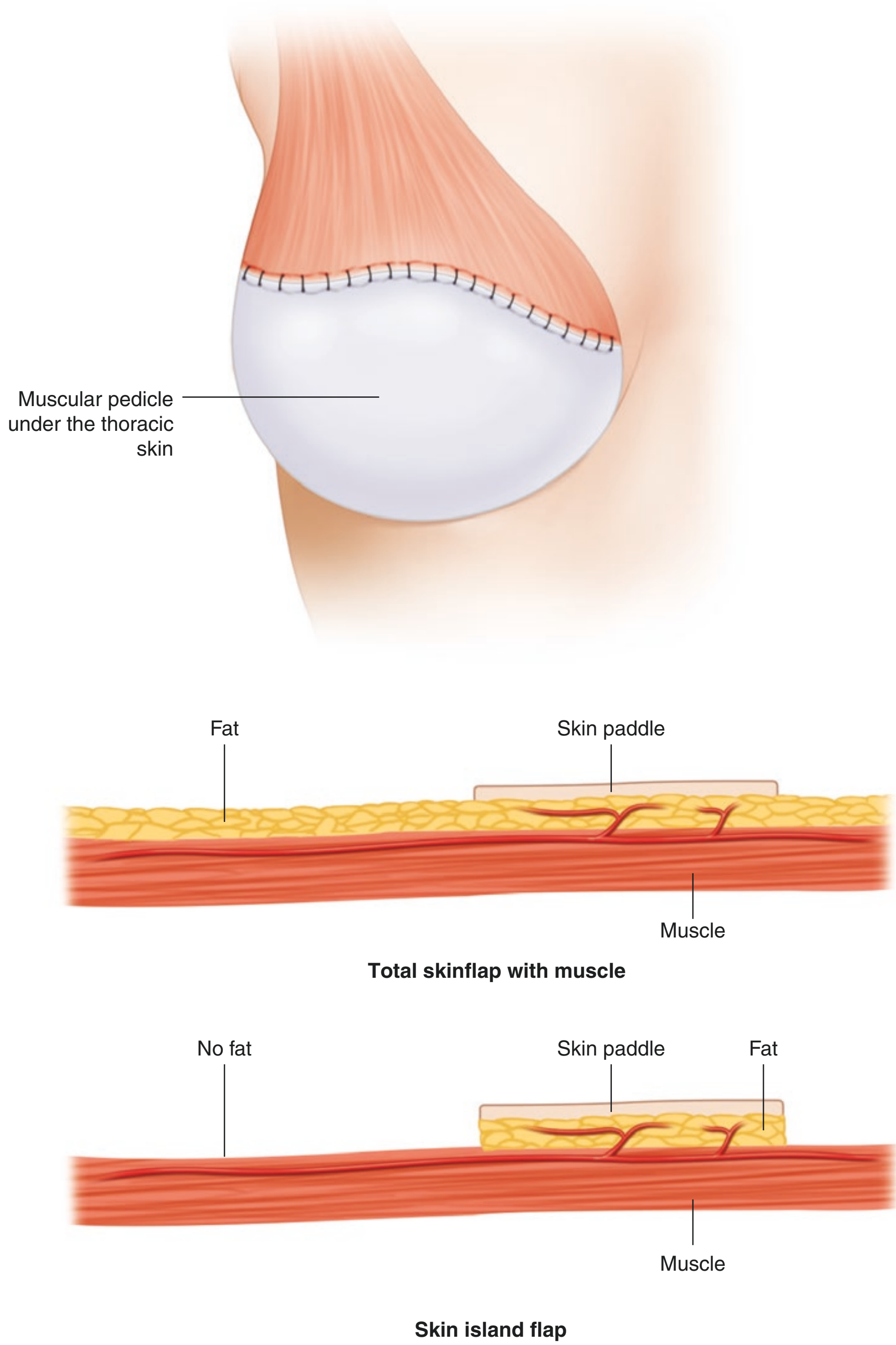



**Fig. 6.12** Latissimus dorsi flap

This incision is made on the previously marked skin surface overlying the latissimus dorsi muscle. The incision is deepened down to the muscle, and an area of adjacent skin and subcutaneous tissue is undermined. The latissimus dorsi flap is mobilized by initially incising muscle along its anterior margin and continuing the dissection posteriorly, using fingers to bluntly dissect the muscle off the underlying rib cage. When the posterior attachments of the flap are freed, its peripheral attachments are severed by sharp dissection, beginning inferiorly and continuing the dissection superiorly. Along the superior aspect of the dissection, care should be taken to identify and preserve the thoracodorsal pedicle, which may have been previously exposed during an axillary dissection. Preservation of the thoracodorsal pedicle is critical, as it provides the blood supply to the latissimus dorsi flap. With blunt dissection, a subcutaneous tunnel is created from the mastectomy defect into the axilla and the tunnel enlarged sufficiently to allow the latissimus dorsi flap, with its pedicle to be rotated anteriorly into the mastectomy defect.

The back wound (from which the latissimus dorsi flap was taken) is closed primarily with a closed suction drain brought out inferior to the wound. The wound is generally closed in two layers with interrupted 3–0 vicryl sutures for the deep dermal layer followed by a running 3–0 subcuticular monocryl stitch. Once the back wound is closed, the bean bag is deflated and removed, and the patient is again rotated to the supine position to complete the reconstruction on the anterior chest wall. The Ioban drape overlying the mastectomy wound is removed, the patient is re-prepped and redraped, and the surgeon is now ready to secure the flap onto the anterior chest wall.

The superior and medial aspects of the latissimus muscle are then sutured to the pectoralis major muscle and fascia. The inferior aspect of the latissimus dorsi muscle is sutured into the rectus abdominis muscle, and the lateral aspect of the latissimus dorsi is sutured to the serratus anterior muscle and fascia. In this manner, a submuscular pocket is created underneath the latissimus. A few of these sutures are left untied, and prostheses of various sizes are placed into this pocket until one of suitable size is found. The appropriately sized prosthesis is left in place, and the sutures are tied down around it. The skin edges of the wound are then re-approximated.

## 6.9 Whole Breast Reconstruction with a De-epithelialized Latissimus Dorsi Muscle and Skin Flap

The accompanying illustration depicts whole breast reconstruction with a de-epithelialized latissimus dorsi flap (Fig. 6.13).

The latissimus dorsi flap (with its de-epithelialized skin paddle) is mobilized and brought into the mastectomy wound as previously described. The de-epithelialized skin paddle is buried under the mastectomy skin flap and folded on itself.

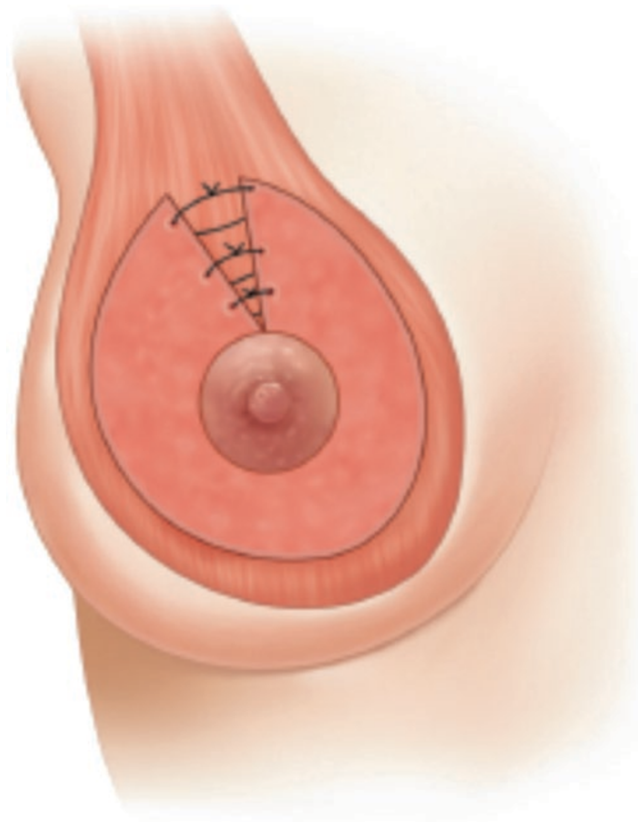


**Fig. 6.13** Breast reconstruction with a totally de-epithelialized latissimus dorsi flap. The de-epithelialized skin paddle is buried under the thoracic skin and folded on itself

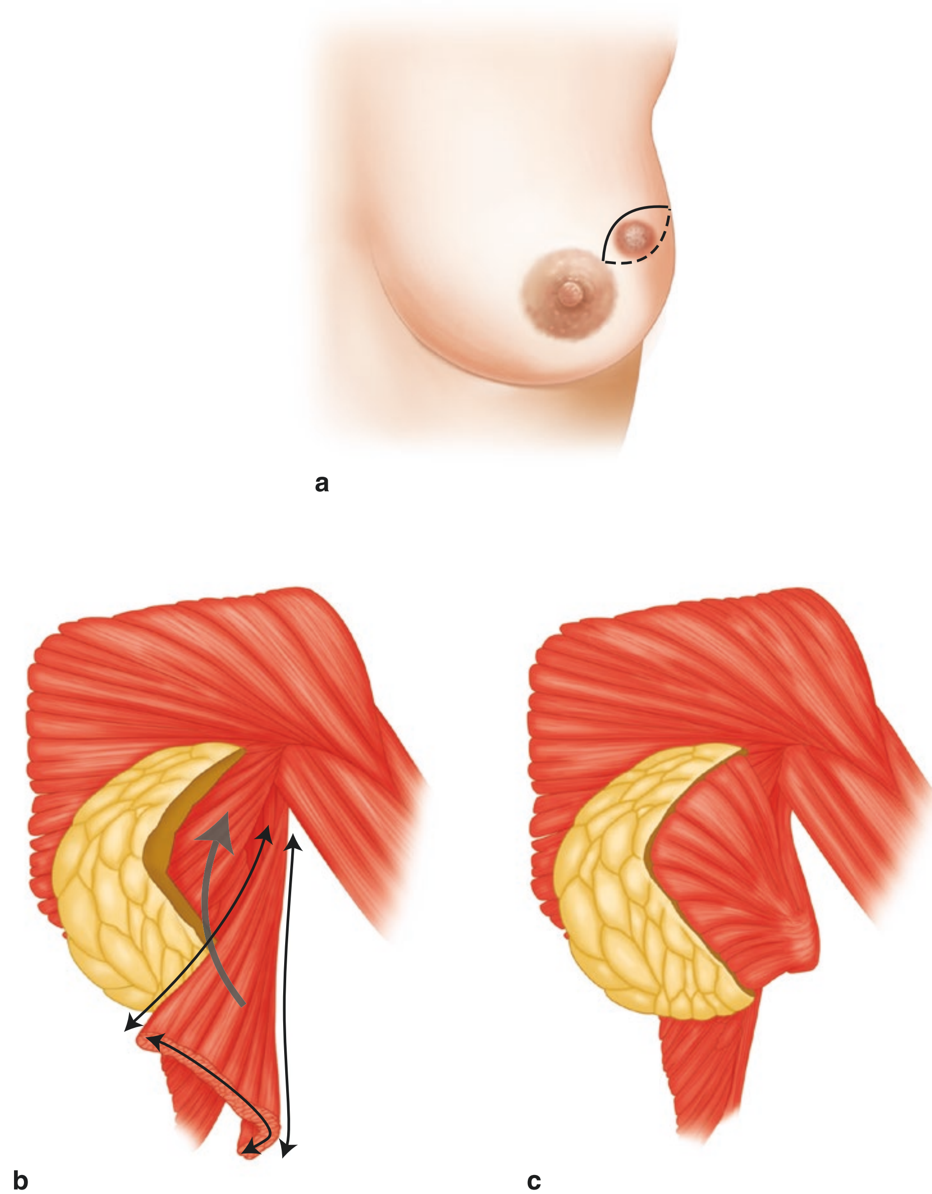
The skin from the anterior surface of the chest wall is then re-approximated, with the latissimus dorsi flap and its de-epithelialized skin paddle buried underneath. This flap provides a mound of tissue beneath the mastectomy skin flap, simulating the breast.

In many cases, the latissimus flap can be used in this way to reconstruct the entire breast without a permanent prosthesis. However in some cases, the latissimus can be combined with an underlying prosthetic implant to restore the necessary breast volume and projection in a single operation. When this technique is used after radiation, the latissimus flap is commonly combined with an underlying tissue expander to allow for safe expansion of a breast mound, protected by the non-irradiated LD flap.

## 6.10 Latissimus Dorsi Flap to Repair Glandular Defects Following Quadrantectomy

Following breast-conserving surgery, a large glandular defect in the upper outer quadrant can be repaired with a latissimus dorsi flap tunneled into the wound as depicted in

**Fig. 6.14** (**a–c**) Quadrantectomy. Glandular defect in the upper outer quadrant; plasty with muscular latissimus dorsi flap




these illustrations. The tissue bulk provided by the latissimus flap improves the cosmetic outcome following breast-conserving surgery (Fig. 6.14a–c).

## 6.11 Autologous Fat Grafting

Another technique for autologous breast reconstruction that has gained popularity in recent years is autologous fat grafting. This process is especially useful as an adjunctive technique for enhancing mastectomy skin flap thickness around implants and restoring volume following breast conservation. Fat injection can also help to increase the size of autologous tissue flaps used in breast reconstruction such as the latissimus dorsi flap or DIEP flap.

Autologous fat grafting has emerged as a critical component of breast reconstruction due to its powerful ability to restore volume to the soft tissue envelope of the breast and improve its quality. Unlike other fillers, fat has the ability to revascularize from surrounding tissue and live permanently in the injected region, surviving on its new blood supply. In addition to adding thickness and volume to the soft tissue envelope, fat also improves the quality of this tissue through rejuvenation and softening. The latter is attributed to the high concentration of stem cells in human adipocytes.

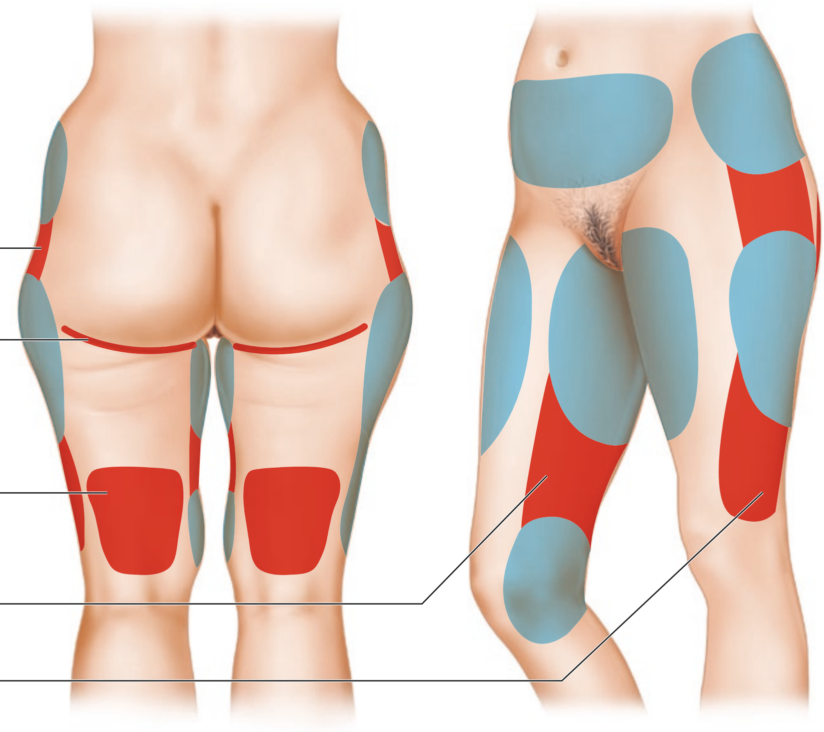



**Fig. 6.15** Zones of fascial attachment, on the lower extremities, depicted in red. These areas should be avoided with liposuction, when harvesting fat for grafting, as they are at high risk for contour deformities

The benefits of fat grafting are numerous and relate to its biocompatibility, availability, versatility, and ability to integrate into host tissues and survive. It has become essential in correcting intractable aesthetic deformities and minor asymmetries that were previously difficult to address. Furthermore, fat grafting has demonstrated low infection rates and has been shown to be oncologically safe in breast cancer patients.

Surgical technique is the key element determining successful outcomes in autologous fat grafting. It ensures that viable cells are being injected and that all cells are given a vascularized environment in which they can survive at the highest rates. The infraumbilical abdomen and thighs are the most commonly chosen donor sites for fat harvest due to both their accessibility with a patient in the supine position and the high concentration of viable adipocytes in these areas.

The surgeon must carefully mark the zones of planned liposuction preoperatively, with the patient standing to ensure that all donor site areas are used equally and symmetrically to avoid a donor site defect. Zones of fascial attachment on the lower extremities should be avoided with liposuction to prevent contour deformities (Fig. 6.15).

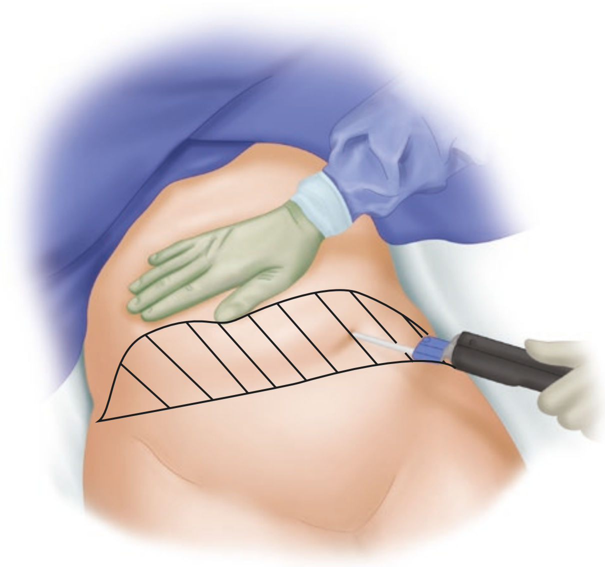


**Fig. 6.16** The use of conventional liposuction techniques to harvest autologous fat for grafting

Fat can be harvested using a variety of techniques, depending on surgeon preference. Methods which have been shown to be safe and effective include conventional liposuction, power-assisted liposuction, and handheld syringe liposuction (Fig. 6.16). With all of these recommended techniques, a blunt tip liposuction cannula should be used for

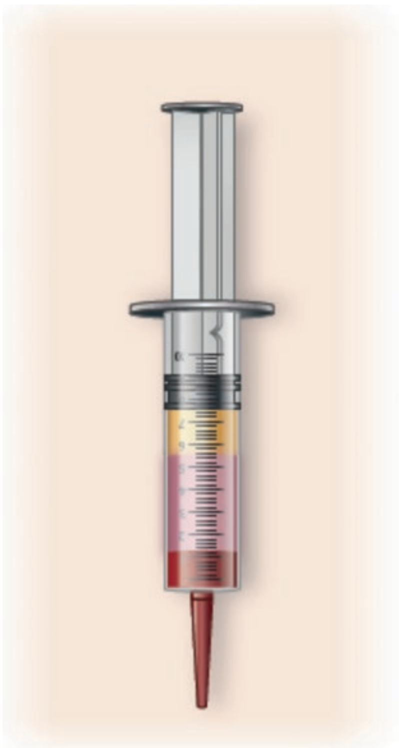


**Fig. 6.17** Example of processed fat, showing separation of oil (top layer), adipocytes (middle layer), and blood (bottom layer); the oil and blood layers will be decanted, leaving only healthy fat for reinjection

safe harvest. Additionally, it has been shown that larger diameter harvest cannulas produce higher concentrations of viable adipocytes than smaller cannulas.

The lipoaspirate is processed after harvesting to remove the majority of oil, blood, tumescent fluid, collagen strands, and lysed cells in the graft. Removal of these components is necessary to more accurately predict the volume correction achievable with grafting; if not removed, they will rapidly resorb after injection resulting in lower volume restoration than anticipated. Many techniques have traditionally been utilized for fat washing and processing including decanting, filtration, and centrifugation (Fig. 6.17).

Following completion of processing, the fat is then loaded into syringes for injection (Fig. 6.18). The key to increasing fat survival is to maximize contact of each injected string of adipocytes with the surrounding host vascularized tissue. To achieve this, the approach during injection is to infiltrate many thin strands of fat, dispersed equally throughout the soft tissue envelope (Fig. 6.19).

When performed in this manner, fat grafting is highly effective in soft tissue augmentation. As such, it has become a preferred adjunctive technique for augmentation of all types of breast reconstruction discussed in this chapter.

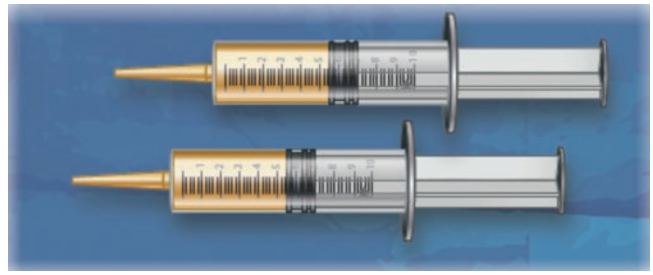


**Fig. 6.18** Following processing, the adipocytes are loaded into injection syringes for grafting

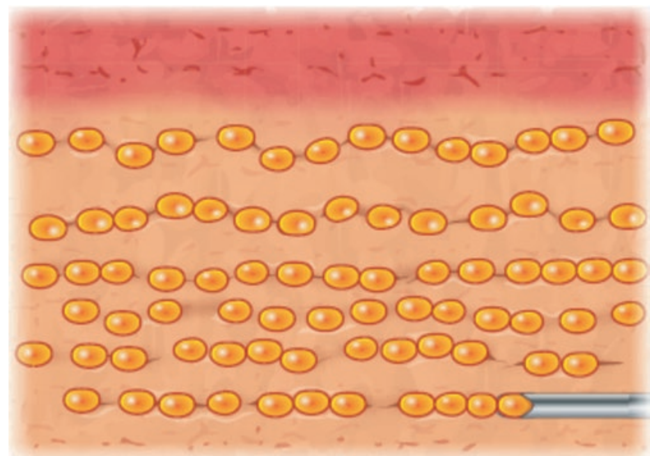


**Fig. 6.19** Proper injection of fat in a "string-of-pearls" fashion is done with thin strands of fat, such that all injected fat is in contact with surrounding vascularized tissue

### 6.11.1 Pedicled TRAM Flap Reconstruction

The pedicled TRAM was the original abdominal-based autologous option for breast reconstruction described in the late 1970s by Hartrampf. Over recent years, with the advent of microsurgical breast reconstruction, the number of pedicle TRAMs performed has decreased. This is due to excessive harvest of abdominal wall fascia with a pedicled TRAM and the need to leave an aperture in the upper abdominal fascia when tunneling the flap. This increases the risk of abdominal bulging postoperatively and can be unsightly. Thus, whenever possible, surgeons should aim to carry out either a free TRAM or DIEP flap that minimizes disruption of the anterior abdominal wall. However, the pedicled TRAM flap remains a good option in centers where microsurgical techniques are not available.

When performing a pedicled TRAM flap for breast reconstruction, preoperative markings are critical. Prior to surgery, the breast mound is outlined using indelible ink with the patient standing. The perimeter of the flap to be taken from the abdominal wall is also outlined. This is done

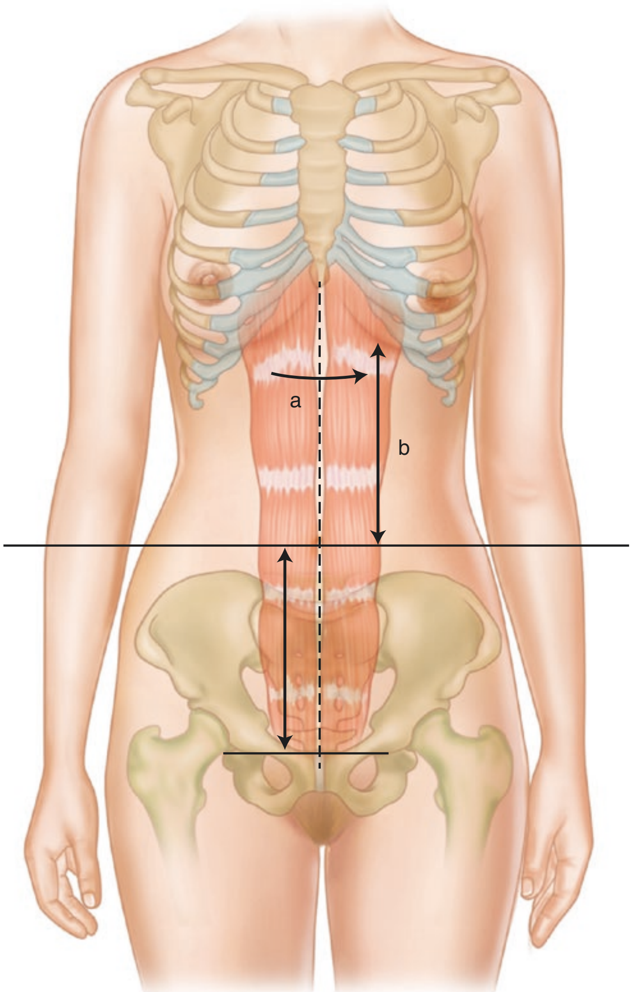



**Fig. 6.20** Pedicled TRAM flap reconstruction. The opening of the costoxiphoid angle facilitates the rotation of the superior portion of the pedicle (*a*). The distance between the umbilicus and the costal border corresponds to the real length of the pedicle and helps to predict whether the pedicle will be tense or not after transfer of the flap (*b*)

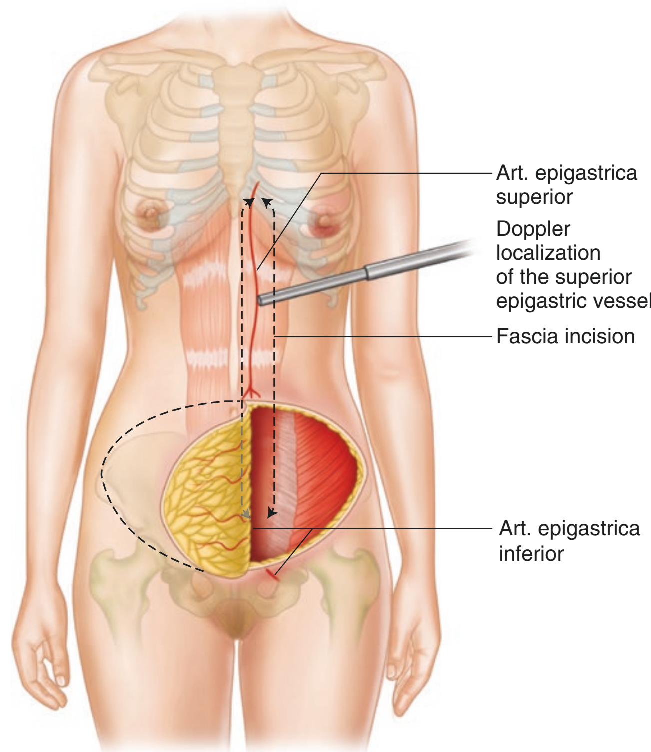



**Fig. 6.21** Pedicled TRAM flap reconstruction

by grasping tissue approximately two fingerbreadths above and below the umbilicus and pulling up on the anterior abdominal wall as much as possible. The surgeon should make certain, by gently pinching the superior and inferior aspects of this tissue, that the edges will easily re-approximate once the flap is taken and the patient is in a sitting position (Fig. 6.20).

The key anatomical structure within the TRAM flap is the rectus abdominis muscle. The rectus abdominis is situated within longitudinal fascial sheaths on the anterior abdominal wall and is readily visible once the skin and subcutaneous tissues of the anterior abdominal wall are retracted anteriorly. The blood supply of the rectus is derived from the superior epigastric artery (a continuation of the internal mammary artery) and the inferior epigastric artery (from the external iliac artery). These vessels enter the posterior aspect of the rectus abdominis muscles. Additional blood supply is derived from the intercostal vessels, which enter the rectus abdominis muscles laterally. The blood supply to the overlying skin is largely derived from perforating branches of the underlying muscles. Thus, branches of the epigastric vessels perforate through the anterior rectus sheath and supply the skin.

The previously outlined skin on the abdominal wall is incised with sharp dissection down to the level of the fascia. Skin and subcutaneous tissues are then undermined superiorly up to the level of the xiphoid. During this dissection, a plane is developed between the subcutaneous tissues and underlying muscle fascia.

The portion of the flap (the random portion) that will not be attached to the underlying rectus muscle is elevated off the contralateral rectus fascia and brought to the midline (the medial aspect of the rectus sheath) (Fig. 6.21).

It is generally recommended that the random portion of the flap paddle is left attached to the rectus until harvesting of the main pedicle is completed. Thus, in the event that the superior epigastric vessels of the main pedicle are injured, there remains the option of using the contralateral pedicle.

The random portion of the flap is composed of skin and subcutaneous tissue, with no underlying muscle. Additionally, the ipsilateral random portion is dissected off the external oblique

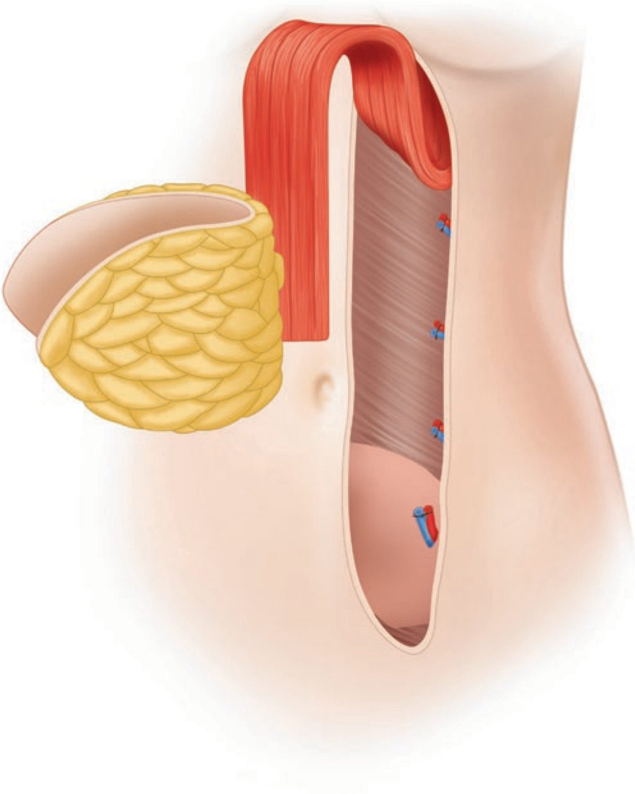


**Fig. 6.22** Complete harvesting of one pedicle

fascia and brought to the lateral aspect of the rectus sheath. The skin overlying the rectus muscle (that will be included in the TRAM flap) is supplied by a row of medial and lateral perforating vessels which should be carefully preserved.

At this point, the surgeon divides the inferior rectus fascia (below the TRAM flap) and identifies the muscle. The surgeon places two fingers underneath the rectus muscle and lifts it anteriorly, thereby placing it under tension. The inferior epigastric pedicle should now be palpable. The muscle is then divided, and the inferior epigastric pedicle is doubly ligated with 3–0 silk and divided. The rectus muscle is dissected free posteriorly, and the lateral aspect of the rectus sheath is divided with a scalpel up to the superior border of the flap. The medial border of the rectus sheath is divided to the level of the umbilicus which is then dissected free from the flap (Fig. 6.22).

The fascia overlying the rectus muscle is then incised up to the level of the xiphoid (Fig. 6.23). The rectus muscle is completely mobilized by sharp and blunt dissection and a tunnel created through the inframammary fold that communicates with the mastectomy wound. The flap is then rotated into the wound (Figs. 6.24 and 6.25). The muscle layer of the flap is sutured to the surrounding pectoralis major muscle, and skin edges are approximated. Jackson–Pratt (or similar) drains are placed in the axilla and the upper abdomen.

Closure of the abdominal wounds is depicted in the accompanying illustrations (Figs. 6.26 and 6.27).

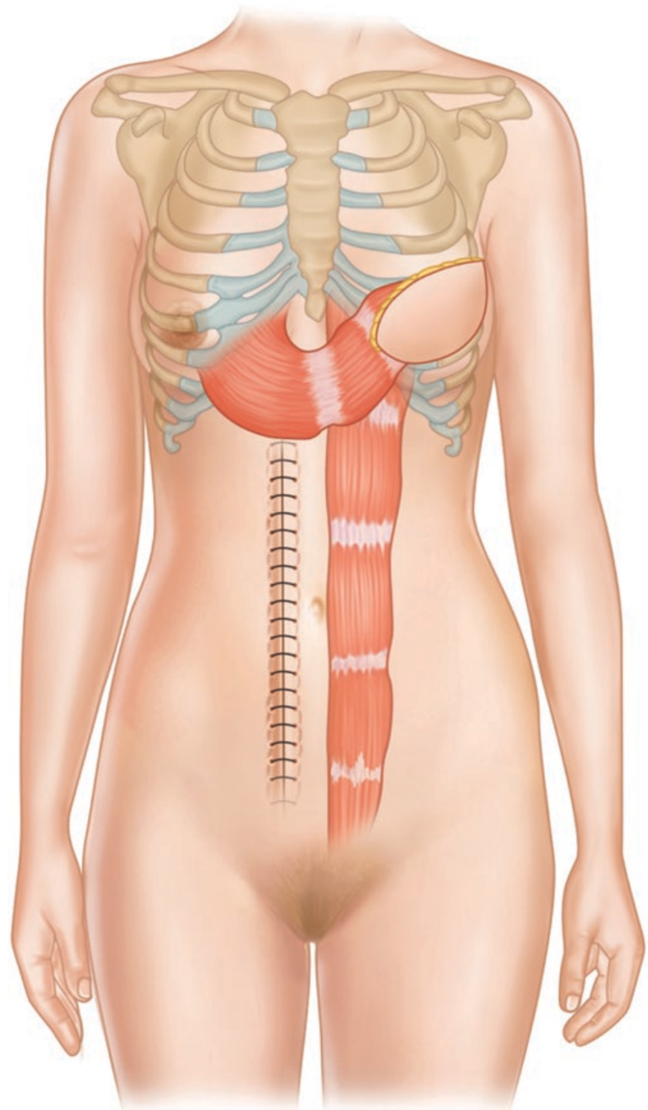


**Fig. 6.23** To avoid lateralization of the umbilicus in the case of a single pedicle TRAM, a small local flap is used

An imbricating running suture is placed in the opposite anterior rectus sheath to help bring the umbilicus to the midline and thereby provide symmetry (Fig. 6.28a–c). In most cases of bipedicle flap reconstruction, a mesh closure is generally necessary (Fig. 6.26a–c).

### 6.11.2 Abdominal Closure

Closure of the abdomen is an important step in the operation and should be done meticulously to avoid complications such as skin necrosis, hernia, and unsightly scars. The suture of the fascia should be done with the patient in the lying position, while the closure of the cutaneous flaps will be done at the end in a sitting position.

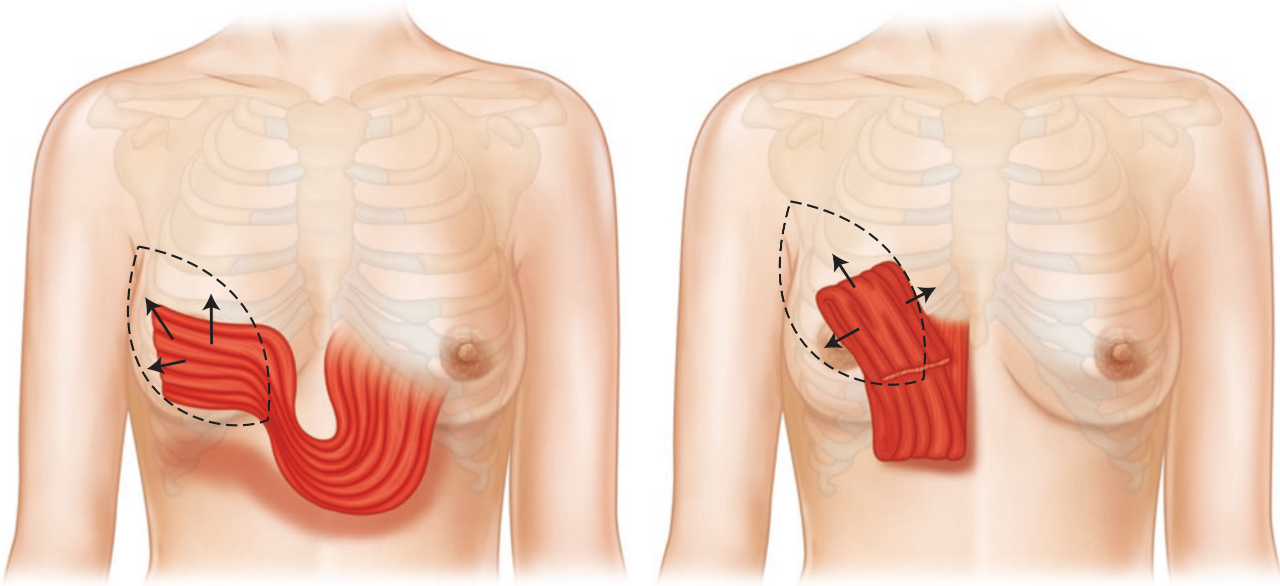


**Fig. 6.24** Rotation of the pedicle

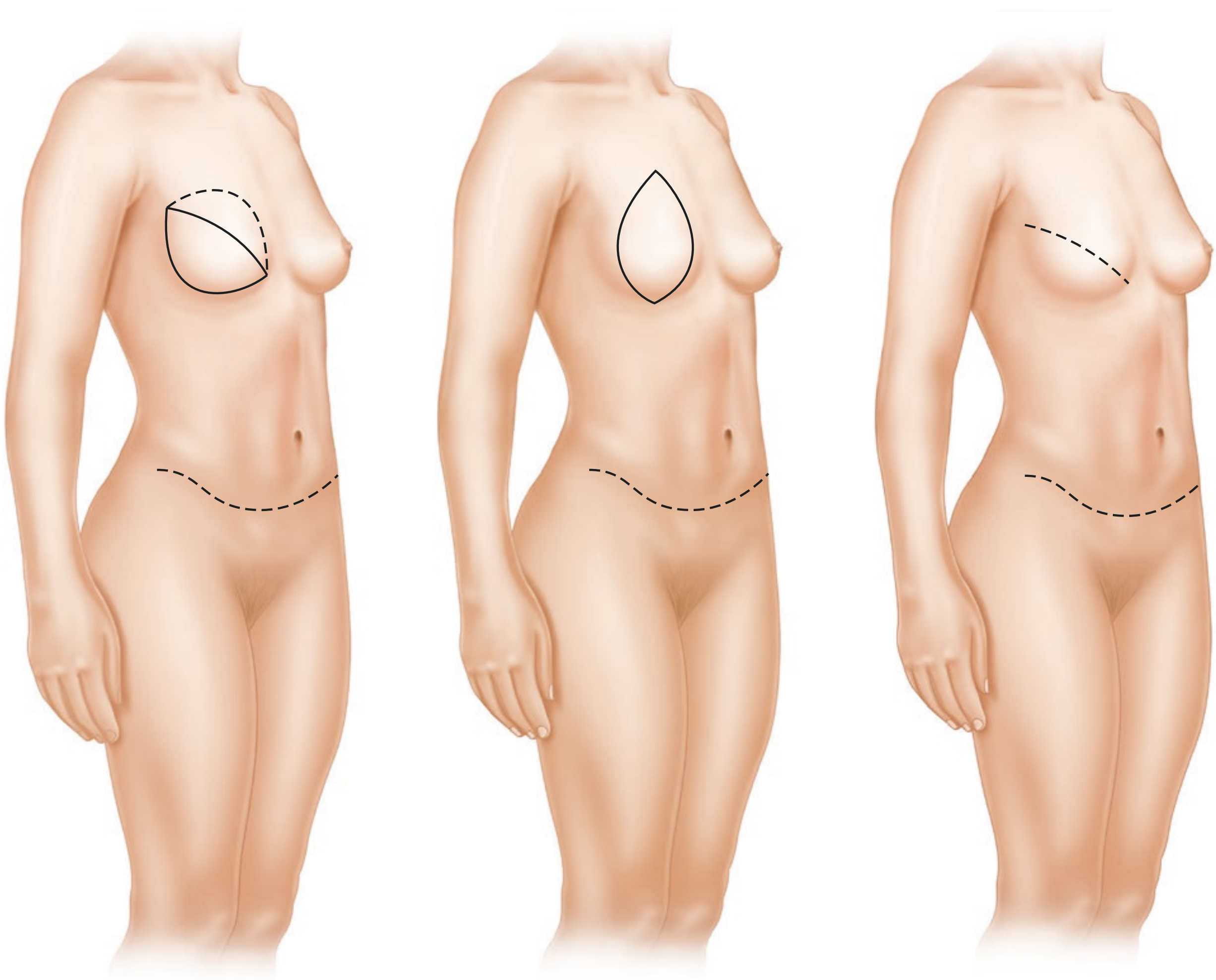


**Fig. 6.25** Positions of the paddle according to the previous positions

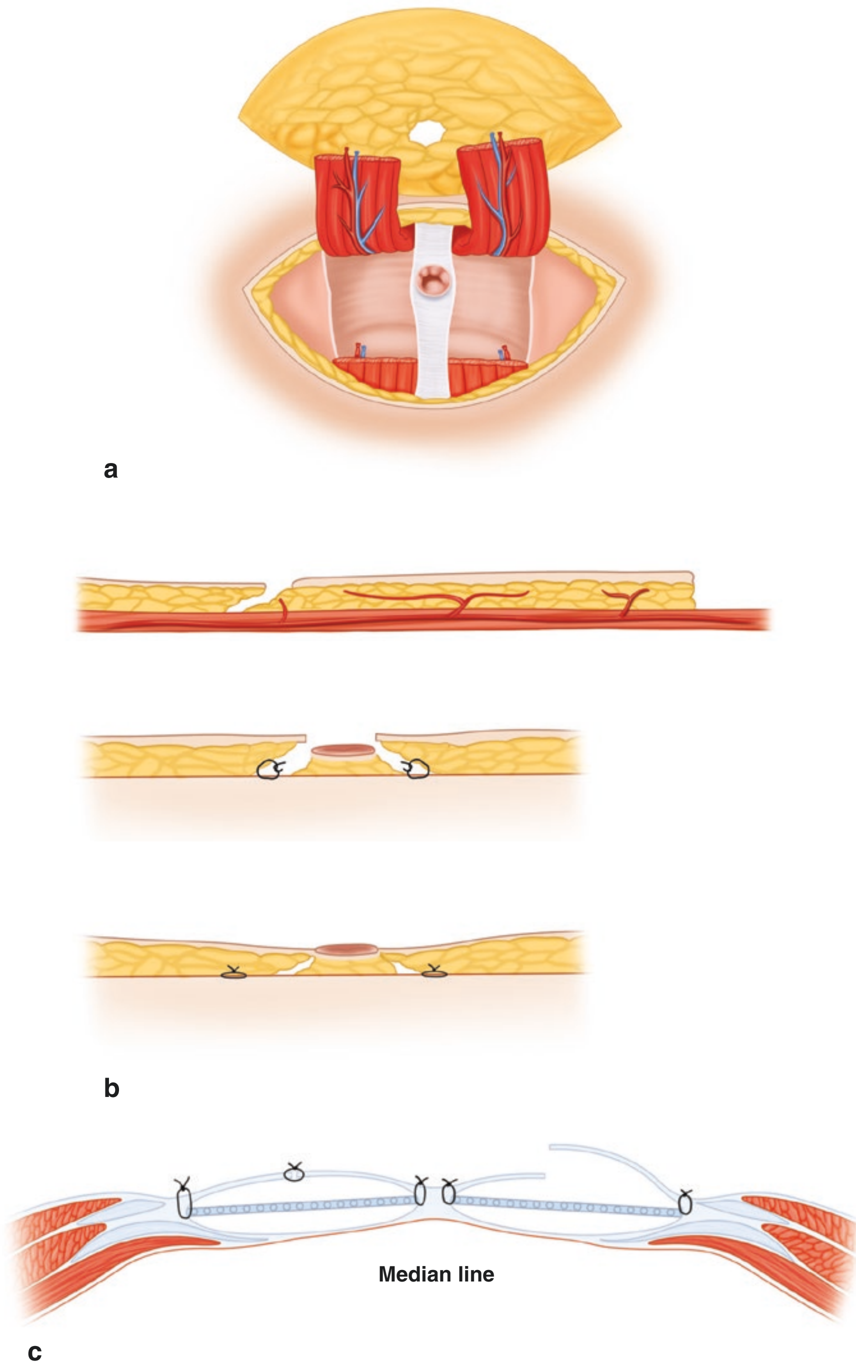



**Fig. 6.26** (**a**) Bipedicle flap. (**b**) Umbilical closure. (**c**) Abdominal closure

The fascia can be closed directly with nonabsorbable stitches under moderate tension and without mesh in the case of a single pedicle. When the fascia seems fragile and the tension therein is questionable, insertion of a mesh is recommended (Fig. 6.27). A nonabsorbable mesh is more secure and can be totally covered by the superficial layer of the rectus fascia. In the case of a double pedicle use of a mesh is essential to prevent herniation. Closure of the fascia with a single pedicle can create excessive tension on the umbilicus that deviates from the midline of the abdomen.

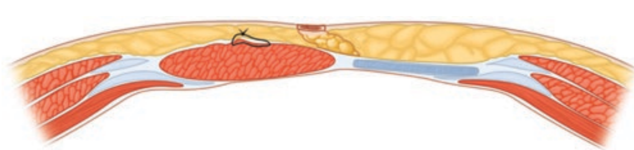


**Fig. 6.27** Abdominal closure TRAM. Centralization of the umbilicus in the case of a single pedicle TRAM

Centralization of the umbilicus can be achieved through plication of the contralateral fascia as shown in Fig. 6.28a–c.

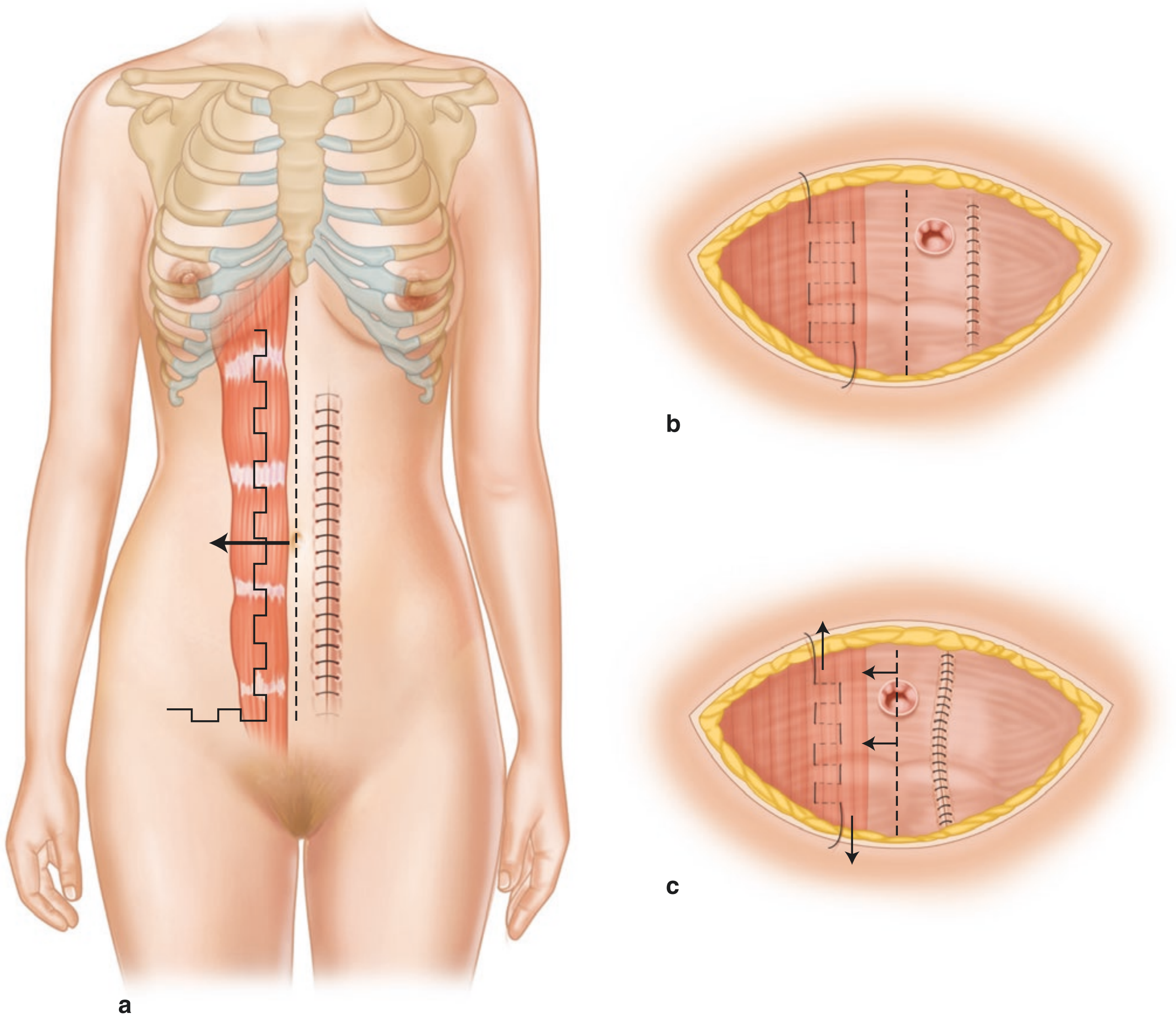



**Fig. 6.28** (**a–c**) Left pedicled TRAM with suture on the right rectus sheath in order to centralize the umbilicus

It is possible to create the future opening for the neo-umbilicus along the median line and to use the reach of the umbilicus to assist accurate positioning.

The cutaneous flaps are closed under tension after raising the patient to the sitting position. Double drain placement is recommended. Upon completion of closure, the color of the flap should be checked to verify the quality of blood supply. If there is any doubt, it is necessary to sit the patient up a little more and remove the area.

Healing of the skin and subcutaneous tissues in the lower abdomen is enhanced with a knowledge of the vascular perforators supplying this area and ensuring their maintenance after surgery. Preoperatively, the abdominal subcutaneous tissue is perfused by perforators in Zone 1 (epigastric perforators from the rectus abdominis), Zone 2 (suprapubic perforators), and Zone 3 (lateral intercostal perforators) (Fig. 6.29). After a TRAM flap reconstruction, the area at greatest risk for vascular depletion is the skin and subcutaneous tissue above the incision. Postoperatively, this area is perfused by Zone 3. Thus, during abdominal closure, this area should undergo minimal undermining in order to maintain these perforators and maximize healing potential.

### 6.11.3 Free Flaps for Autologous Breast Reconstruction

(a) Transverse Rectus Abdominis Myocutaneous (TRAM) Free flap

TRAM free flaps require the use of microsurgical procedures. In the classic TRAM free flap, a full width of rectus muscle together with the subcutaneous tissue

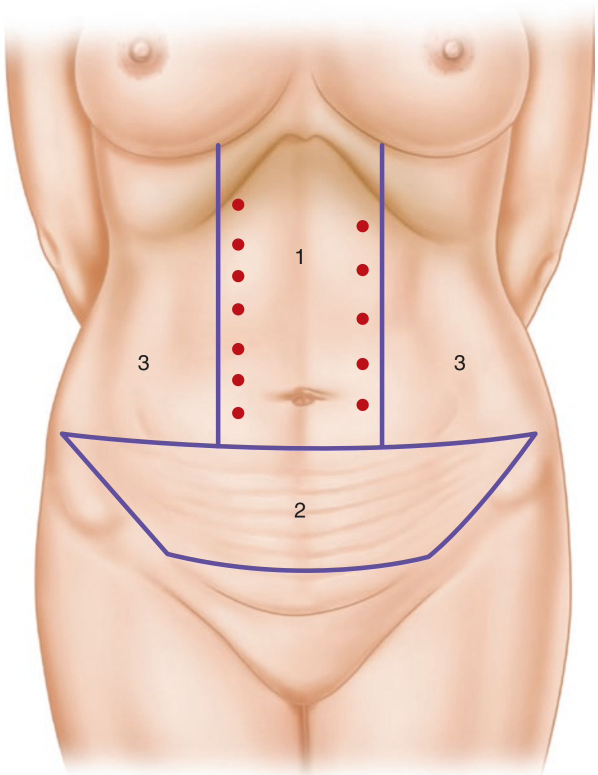



**Fig. 6.29** The zones of abdominal subcutaneous tissue and skin perfusion

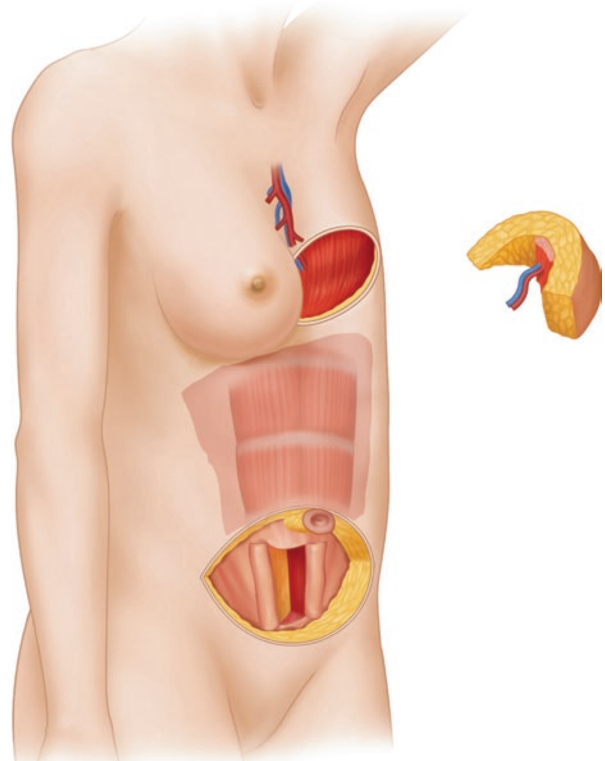


**Fig. 6.30** A free TRAM flap, after harvest, prior to vascular anastomosis in the chest. The abdominal donor site shows the skin and muscle that are removed as part of the flap

and skin paddle is removed at the level of the inferior epigastric vessels. The inferior epigastric vessels are freed of surrounding tissue and prepared for microvascular anastomosis (Fig. 6.30). It is the anastomosis in the chest between the inferior epigastric vessels and either the internal mammary or thoracodorsal vessels that allows the TRAM flap to survive. After harvesting of the flap, the abdominal donor site on the side of vessel harvest lacks a full width of rectus muscle (Fig. 6.31).

(b) Deep Inferior Epigastric Perforator (DIEP) Flap

The DIEP flap removes the same skin and subcutaneous abdominal tissue island as a TRAM flap. However, the DIEP flap spares the entire donor site rectus abdominis muscle. This is made possible by dissecting the specific perforators from the epigastric vessels, as they pass through the muscle, and leaving the muscle itself intact within the anterior abdominal wall (Fig. 6.32). In this way, the flap remains well perfused but is supplied by individual perforators that have been dissected free from the muscle (Figs. 6.33 and 6.34). This allows the patient to maintain intact abdominal core anatomy and strength without functional compromise (Fig. 6.35).

(c) Transverse Upper Gracilis (TUG) Flap

A secondary option for the flap donor site in autologous breast reconstruction is the medial thigh fat. This fat can be

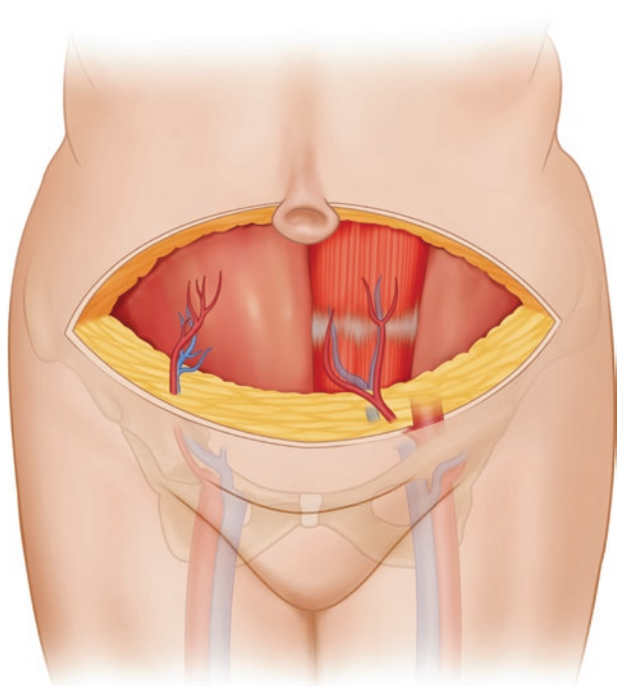


**Fig. 6.31** Abdominal donor site after harvest of a right TRAM flap. On the right hemi-abdomen, the side of the inferior epigastric vessel harvest, there is a full width removal of a strip of rectus abdominis muscle

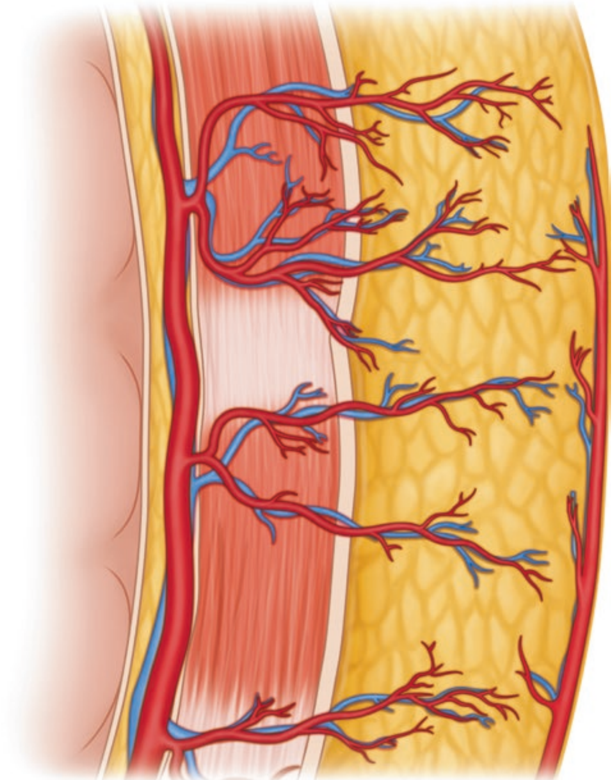


**Fig. 6.32** Cross-sectional view of vascular perforators coming from the deep inferior epigastric vessels, through the rectus abdominis muscle, to the overlying lower abdominal skin and fat of the DIEP flap. With DIEP dissection, these individual perforators are dissected free from the muscle, thus preserving all the muscle on the abdominal wall, and not harvesting it with the flap

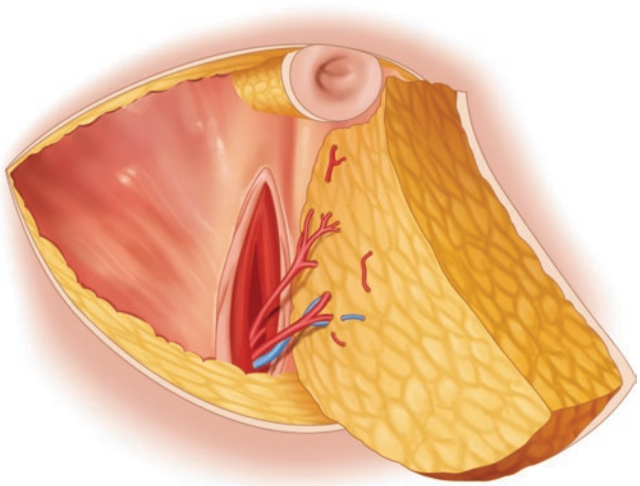


**Fig. 6.33** Completed dissection of DIEP flap on the abdomen. Vascular perforators have been dissected through the preserved rectus muscle

harvested together with the underlying gracilis muscle and its blood supply (medial circumflex femoral artery and vein) as a free flap for breast reconstruction (Fig. 6.36).

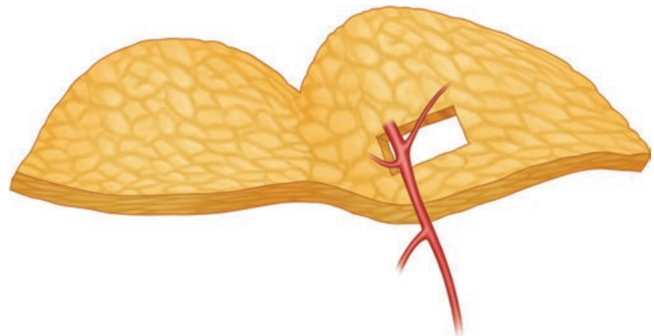


**Fig. 6.34** Completely dissected DIEP flap, following removal from the abdomen, prior to microvascular anastomosis on the chest. Note that no abdominal muscle has been taken as part of this flap

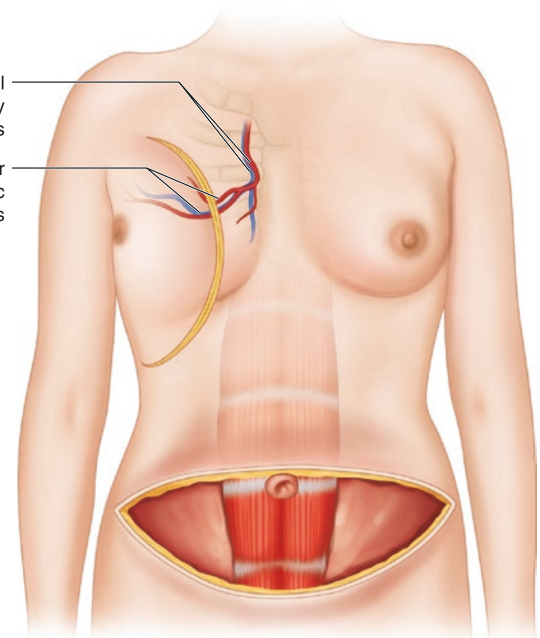



**Fig. 6.35** Completed anastomosis of DIEP flap, showing revascularized flap on chest, and condition of abdominal donor site, with full muscle preservation

(d) Supper Gluteal Artery Perforator (SGAP) and Inferior Gluteal Artery Perforator (IGAP) Flap

Another option for the flap donor site is the gluteal subcutaneous tissue and skin. This autologous tissue can be harvested on vascular perforators from either the superior gluteal artery and vein (SGAP free flap) or inferior gluteal artery and vein (IGAP free flap) (Fig. 6.37).

## 6.12 Nipple Reconstruction

The creation of a nipple–areola complex following breast reconstruction improves cosmetic outcome and many patients request such a procedure. The most popular tech-

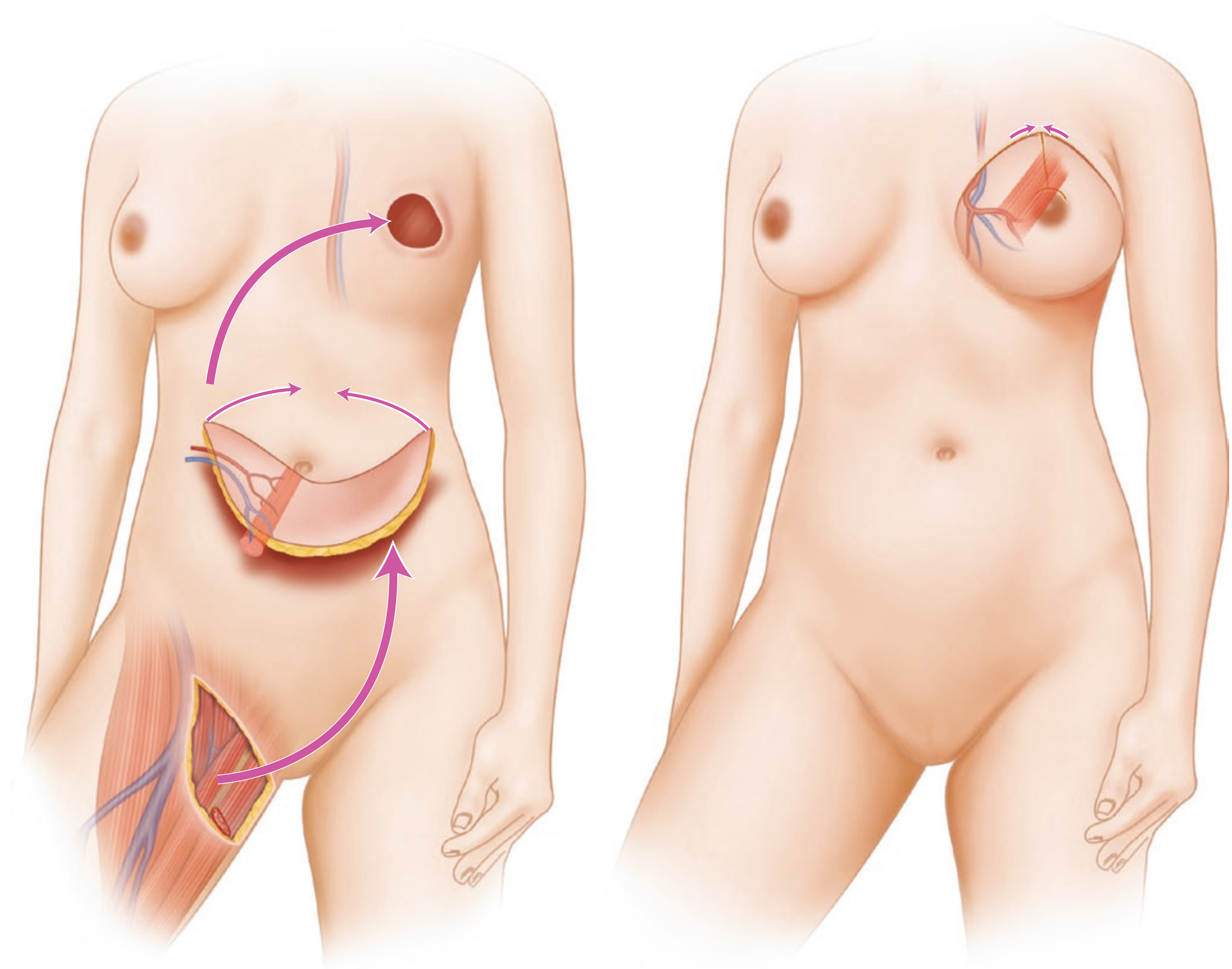


**Fig. 6.36** Harvest of a right TUG free flap for left breast reconstruction after mastectomy

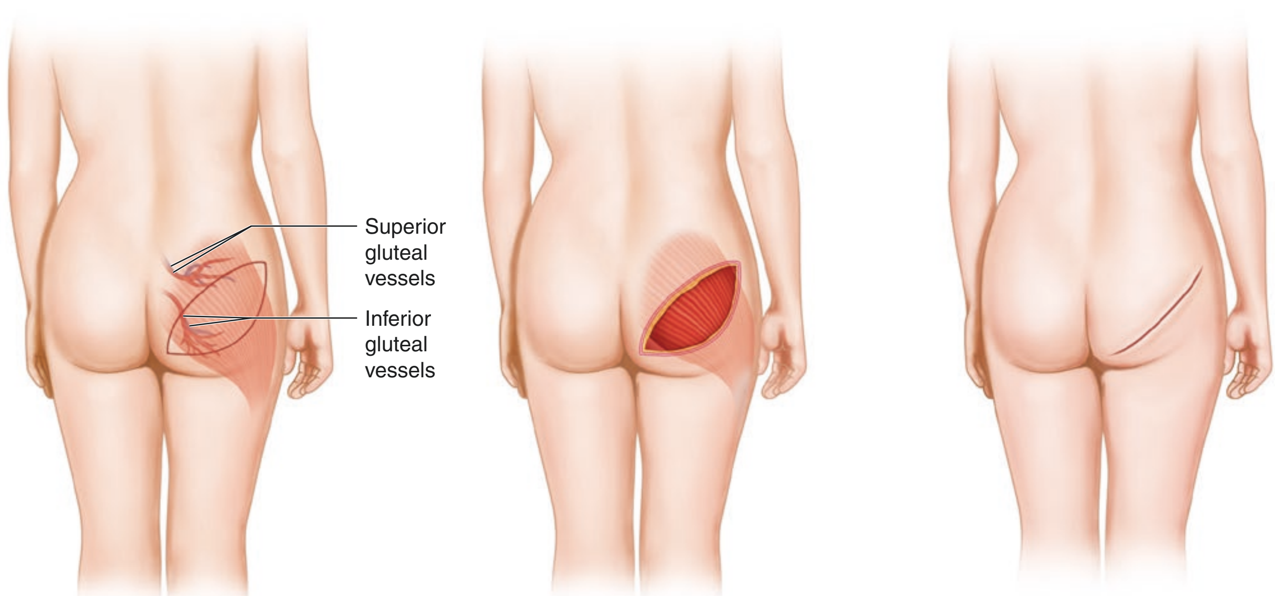



**Fig. 6.37** Harvest of a right SGAP free flap for breast reconstruction after mastectomy

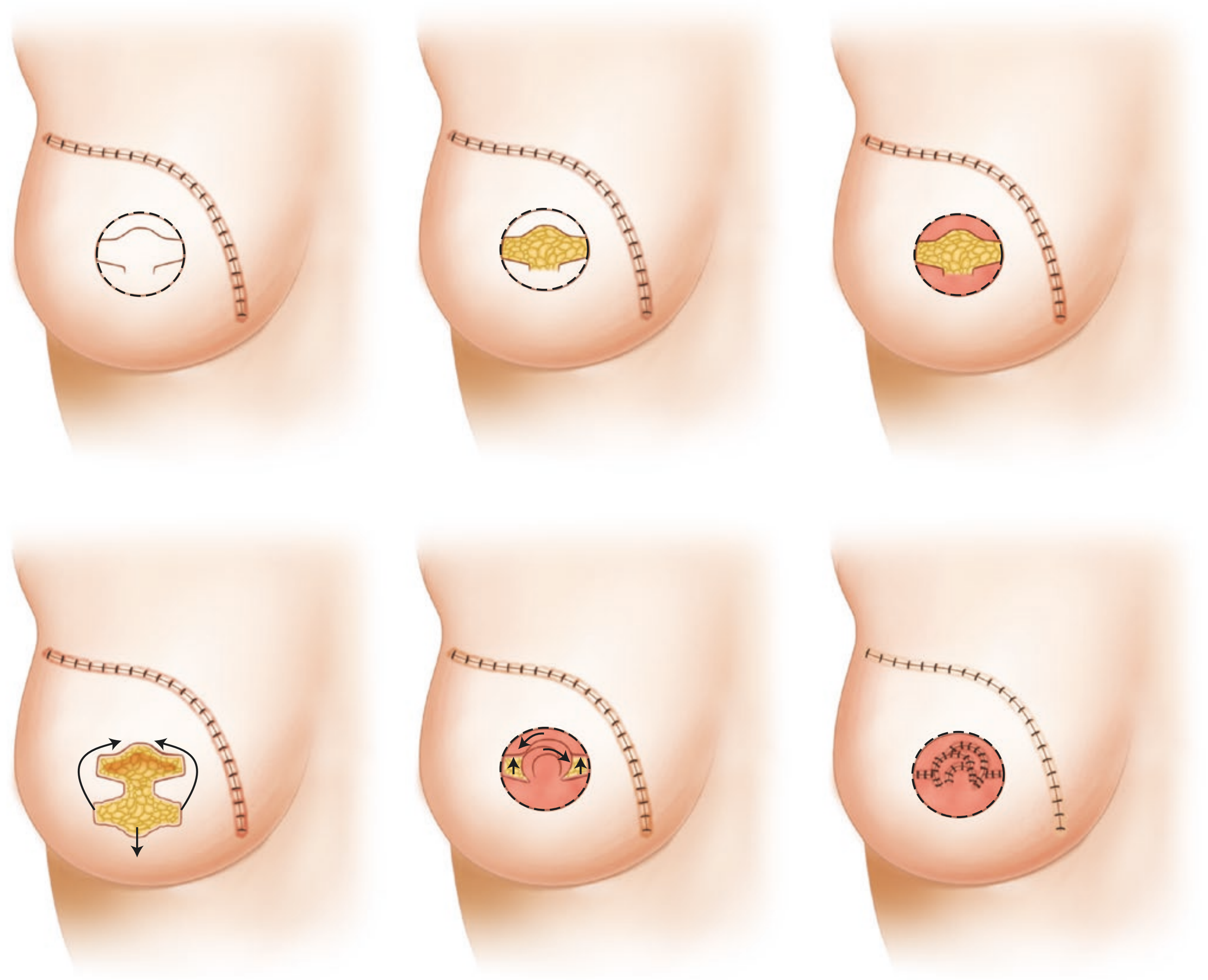


**Fig. 6.38** Nipple–areola reconstruction (color of the areola and the nipple is obtained by tattooing the surface of the circle)

nique for nipple reconstruction combines a tattoo procedure with a small triangular skin flap that is often referred to as a skate flap, illustrated in Fig. 6.38. The location of the areolar should be drawn preoperatively with the patient in the standing position to check for bilateral symmetry of the nipple–areola complex. The nipple–areola reconstruction is generally performed as a second-stage procedure under local anesthesia. The tattooing should be done prior to reconstructing the nipple. A skin flap is then developed and folded on itself and sutured with 4–0 absorbable sutures, as shown in the accompanying illustrations. The angle of the skin flap should be oriented appropriately if it is in the vicinity of the previous mastectomy scar (Fig. 6.39).

For those patients who require enhanced projection of the reconstructed nipple, there is the potential for placement of inserts within these reconstructions. The most commonly used nipple inserts consist of silicone blocks or small pieces of ADM. This can be useful to obtain long-term projection but is accompanied by risk of extrusion and subsequent skin breakdown.

There is an option of three-dimensional (3D) tattooing for those women undergoing skin-sparing mastectomy who do not wish to undergo a separate surgical procedure for nipple reconstruction. This can be performed on an outpatient basis as a non-surgical procedure and can yield long-lasting results with a realistic appearance of the nipple and areola (matched for color before mastectomy).

## 6.13 Oncoplastic (Post-lumpectomy) Breast Reconstruction

While post-mastectomy whole breast reconstruction remains the most commonly performed oncologic reconstruction, increasing use of oncoplastic techniques alongside partial mastectomy (breast conservation surgery) procedures has

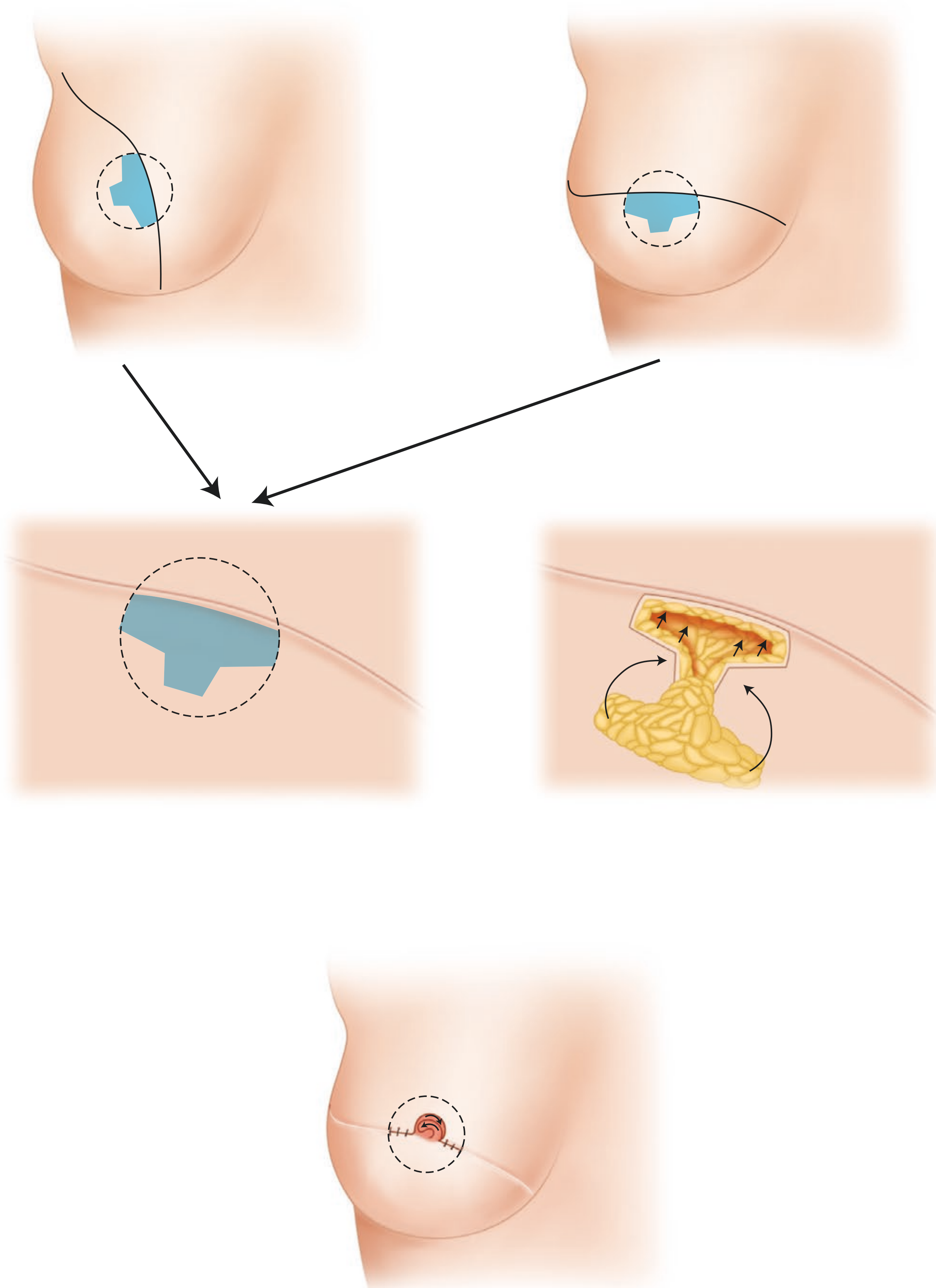


**Fig. 6.39** Nipple–areola reconstruction in the vicinity of the previous mastectomy scar

been notable in recent years. This is due to the severity of lumpectomy breast defects and a desire to avoid them by undertaking partial breast reconstruction. As such, two oncoplastic techniques are now commonly employed at the time of partial mastectomy: local tissue rearrangement and oncoplastic reduction mammoplasty.

The aim is to perform these reconstructive techniques at the time of oncologic tissue resection as a preventative technique; once these defects have become apparent in the breast, they are very challenging to repair and reconstruct secondarily (especially when patients proceed to radiation therapy). When techniques for oncoplastic reconstruction are compared in terms of morbidity, those performed prior to radiation therapy are associated with significantly fewer complications compared to post-irradiation procedures.

Local tissue rearrangement tends to be performed in those patients with smaller breasts and tumor size with minimal preoperative ptosis. Following excision of breast tissue, the remaining healthy surrounding breast parenchyma is mobilized as vascularized flaps and advanced for insetting into the lumpectomy cavity. This obliterates any potential dead space and reduces the likelihood of long-term contour deformities as well as seroma formation and infection.

Oncoplastic breast reduction (mammoplasty) is performed on patients with larger preoperative breast size (C to D cup) who have grade 2 or 3 ptosis. This procedure necessitates a large skin resection and is performed on both breasts (including the non-cancerous contralateral breast) to maintain postoperative symmetry. This operation involves a standard breast reduction using either a wise or vertical pattern technique. The nipple pedicle can be placed at any site (depending on tumor location) such that this tissue is safely preserved. This technique has great versatility and allows for planning a lumpectomy as part of a standard breast reduction with removal of the affected breast quadrant. The final result is an aesthetically favorable breast mound with correction of ptosis and avoidance of any contour deformities.

For many patients, preoperative tumor size may be excessively large for breast conservation. However, neoadjuvant chemotherapy can be employed to shrink the tumor and convert patients from requiring mastectomy to being candidates for oncologically safe breast conservation. Furthermore, even when postoperative adjuvant radiation therapy is required, this option can result in lower complication rates compared to mastectomy with whole breast reconstruction followed by PMRT.

Thus, oncoplastic reduction mammoplasty allows for conservation of the breasts with improved aesthetic outcome together with potential reduction in postoperative complication rates. Similarly, this option can be advantageous in the setting of axillary lymph node dissection where mastectomy and whole breast reconstruction is reported to be associated with higher complication rates, especially infection.

## 6.14 Thoracoepigastric Cutaneous Flap for Partial Breast Reconstruction

In some cases of quadrantectomy and breast conservation, the size of the breast resection defect is unsuitable for either local tissue rearrangement or oncoplastic breast reduction which would otherwise leave an unacceptable result. In such cases, a volume replacement technique must be used which will restore the excised breast tissue and offer a similar breast size and shape as the preoperative state (rather than a complete reshaping of the breast).

As previously discussed in this chapter, a common option for partial breast reconstruction remains the latissimus dorsi (LD) myocutaneous flap. This flap allows for large amounts of subcutaneous tissue and skin to be harvested from the back, and this makes it ideal for inferior (lower pole) and inferolateral defects following breast conservation.

Two other options which are gaining in popularity for partial breast reconstruction are the thoracodorsal artery perforator (TDAP) flap and the lateral intercostal artery perforator (LICAP) flap. These chest wall perforator flaps have the advantage of a more acceptable donor site defects compared with the LD flap but can be associated with relatively long scars.

The TDAP flap involves harvest of a skin and subcutaneous tissue island similar to the LD flap but without the latissimus muscle. This fasciocutaneous island is perfused by the descending branch of the thoracodorsal artery, and the transverse area of soft tissue can reliably cover an area of 20 × 10 cm based on the vascular pedicle.

The LICAP flap is often used in women who lack availability of abdominal or latissimus donor sites for autologous tissue. In this case, excess lateral chest wall tissue which creates a subcutaneous fold in many women can be used as a vascularized fasciocutaneous flap for partial breast reconstruction. Anatomic studies have shown that there are typically between 2 and 5 lateral intercostal perforators present within 6–8 cm of the mid-axillary line. A single perforator with a diameter of at least 5 mm can supply the entire lateral skin and subcutaneous tissue island. This tissue can then be rotated 180 degrees from the back to the anterior chest and thereby used to reconstruct partial breast defects.

## 6.15 Reduction Mammoplasty

Breast which are heavy and pendulous are a source of chronic pain and discomfort for many women. Although some may request reduction mammoplasty to relieve pain and discomfort, many women also have an expectation that the procedure will improve their appearance.

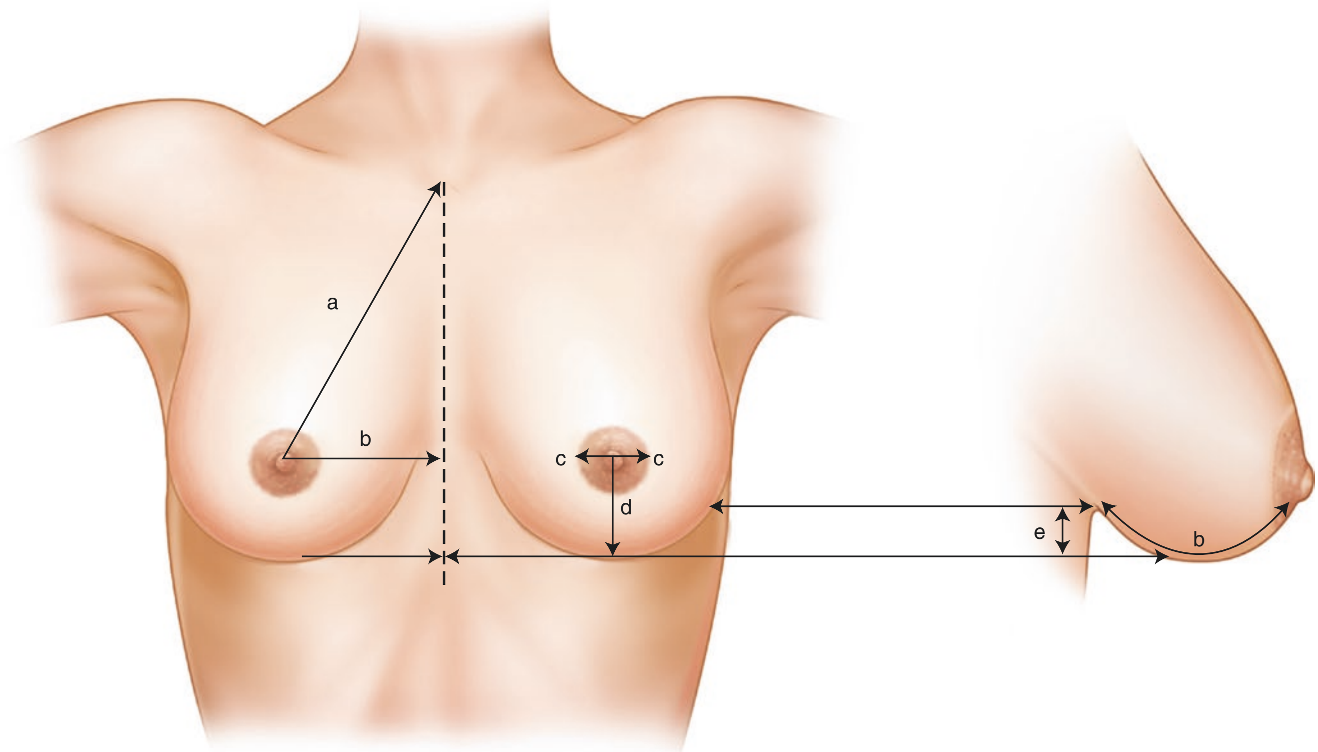



**Fig. 6.40** Measurements required prior to reduction mammoplasty. *a* = 19–21 cm; *b* = 9–11 cm; *c* = 4–5 cm; *d* = 5–8 cm; *e* = 0–2 cm

Prior to undertaking breast reduction mammoplasty the surgeon should document several useful measurements that are indicated in Fig. 6.40.

Additionally, the breasts should be marked with the patient in the standing position and clearly indicate the planned incision pattern as depicted in the accompanying illustration (Fig. 6.41).

Reduction mammoplasty can be performed using a vertical technique where a superior pedicle is left intact to provide a blood supply to the nipple–areola complex (Fig. 6.42a). Alternatively, the procedure can be performed with an inferior pedicle which provides sufficient blood supply to the nipple–areola complex (Fig. 6.42b).

Both the superior pedicle technique and the inferior pedicle technique are illustrated in Fig. 6.42. Specifically, these drawings depict the contours of the breast tissue specimen that is obtained after using the superior pedicle and inferior pedicle techniques respectively for reduction mammoplasty (Fig. 6.42c, d).

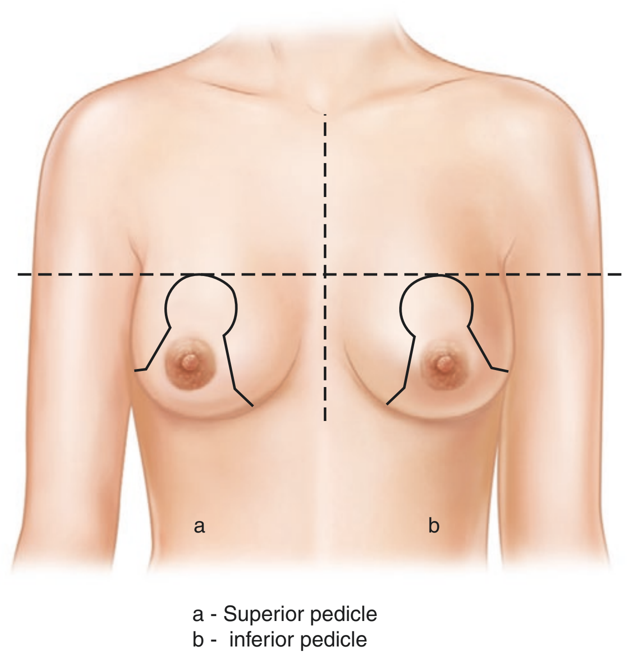



**Fig. 6.41** Reduction mammoplasty

## 6.16 Reduction Mammoplasty: Vertical Technique (Lejour)

Figure 6.43 depicts a surgeon's preoperative markup for a reduction mammoplasty utilizing the vertical scar technique (Lejour). The drawing shows the limit of the supra-areolar de-epithelialization (1, in Fig. 6.43a), the medial limit of infra-areolar de-epithelialization (2, in Fig. 6.43a), the lateral

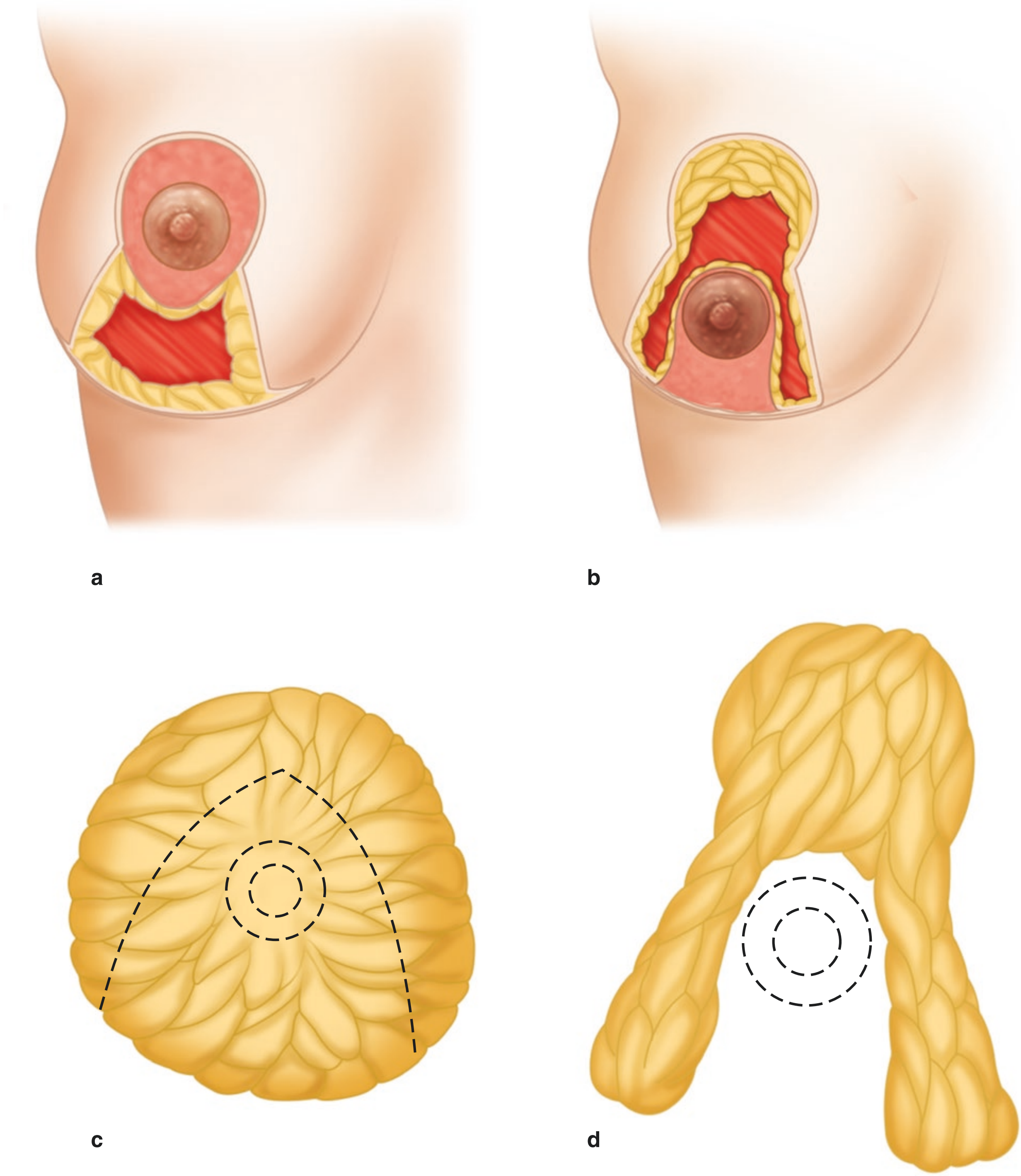



**Fig. 6.42** (**a-d**) Reduction mammoplasty

limit of infra-areolar de-epithelialization (3, in Fig. 6.43b), and the inferior aspect of the resection (4, in Fig. 6.43c).

The accompanying illustrations briefly summarize the key features of the reduction mammoplasty utilizing the vertical technique (Lejour). A margin of tissue around the nipple–areola complex is de-epithelialized (1, in Fig. 6.43a). The surgeon then undermines a wide area of tissue anterior to the serratus anterior and pectoralis major muscles. Breast tissue in the inferior quadrant is then resected (Fig. 6.44) followed by re-apposition of glandular tissue with absorbable

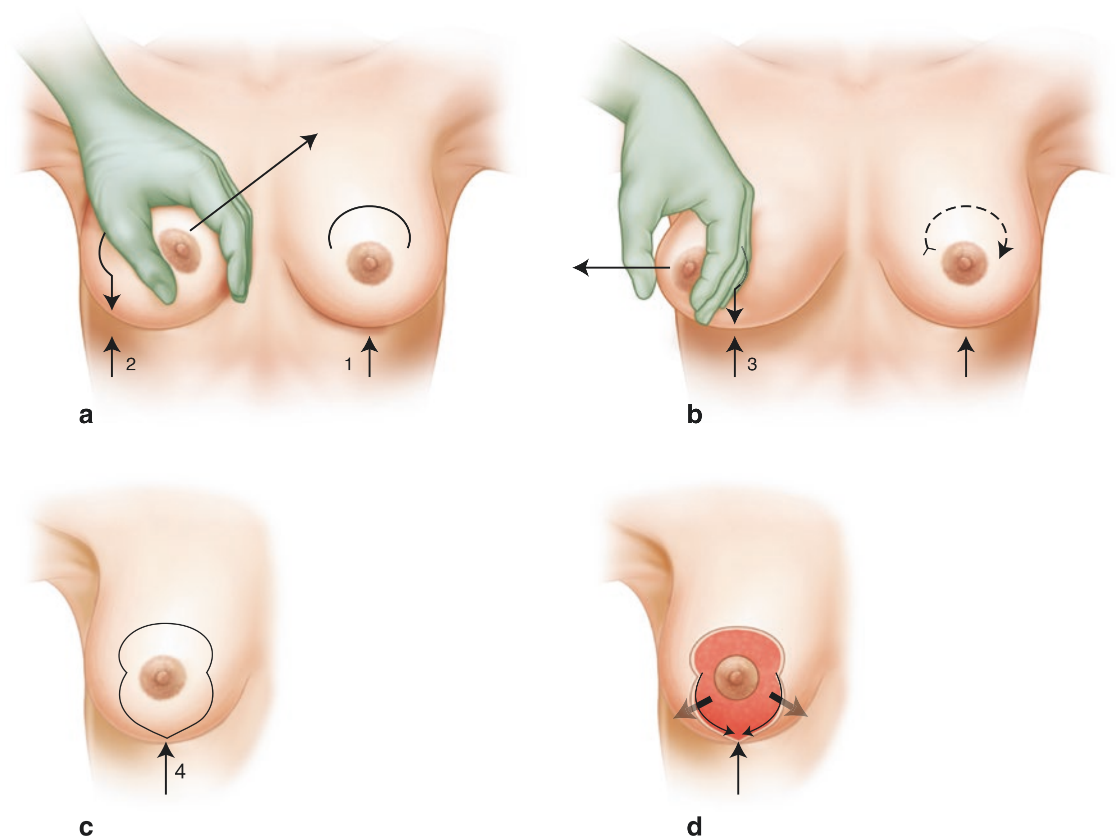



**Fig. 6.43** (**a–d**) Reduction mammoplasty; vertical scar technique (Lejour)

stitches (Fig. 6.45). The skin edges are re-approximated with interrupted 3–0 monocryl stitches (Fig. 6.45) which includes the de-epithelialized tissue around the nipple–areola complex and closure of the inferior vertical incision.

Further key aspects of the reduction mammoplasty using the vertical technique (Lejour) are depicted in Fig. 6.43. Seen here is the appearance of the breast after de-epithelialization with a section of the glandular tissue shown inferiorly. The illustration above (Fig. 6.42 a, b) depicts the appearance of the breast tissue after glandular resection. The illustration below (Fig. 6.42c, d) depicts the appearance of the glandular tissue that has been resected and sent to the pathologist.

This illustration (Fig. 6.42a–d) further demonstrates the technique of wide retroglandular undermining anterior to the pectoralis major muscle. This undermining allows the surgeon to eventually restore the continuity of the gland after resection and also to bimanually palpate the breast to check for the presence of any tumors.

Seen in this illustration (Fig. 6.42a–d) is the appearance of the breast after peri-areolar and inferior de-epithelialization, with undermining of the lower glandular tissue.

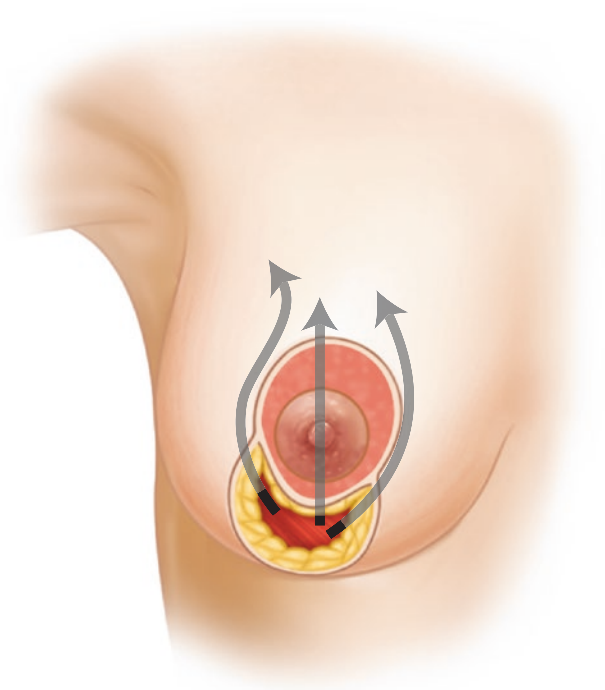


**Fig. 6.44** Reduction mammoplasty; vertical scar technique (Lejour)

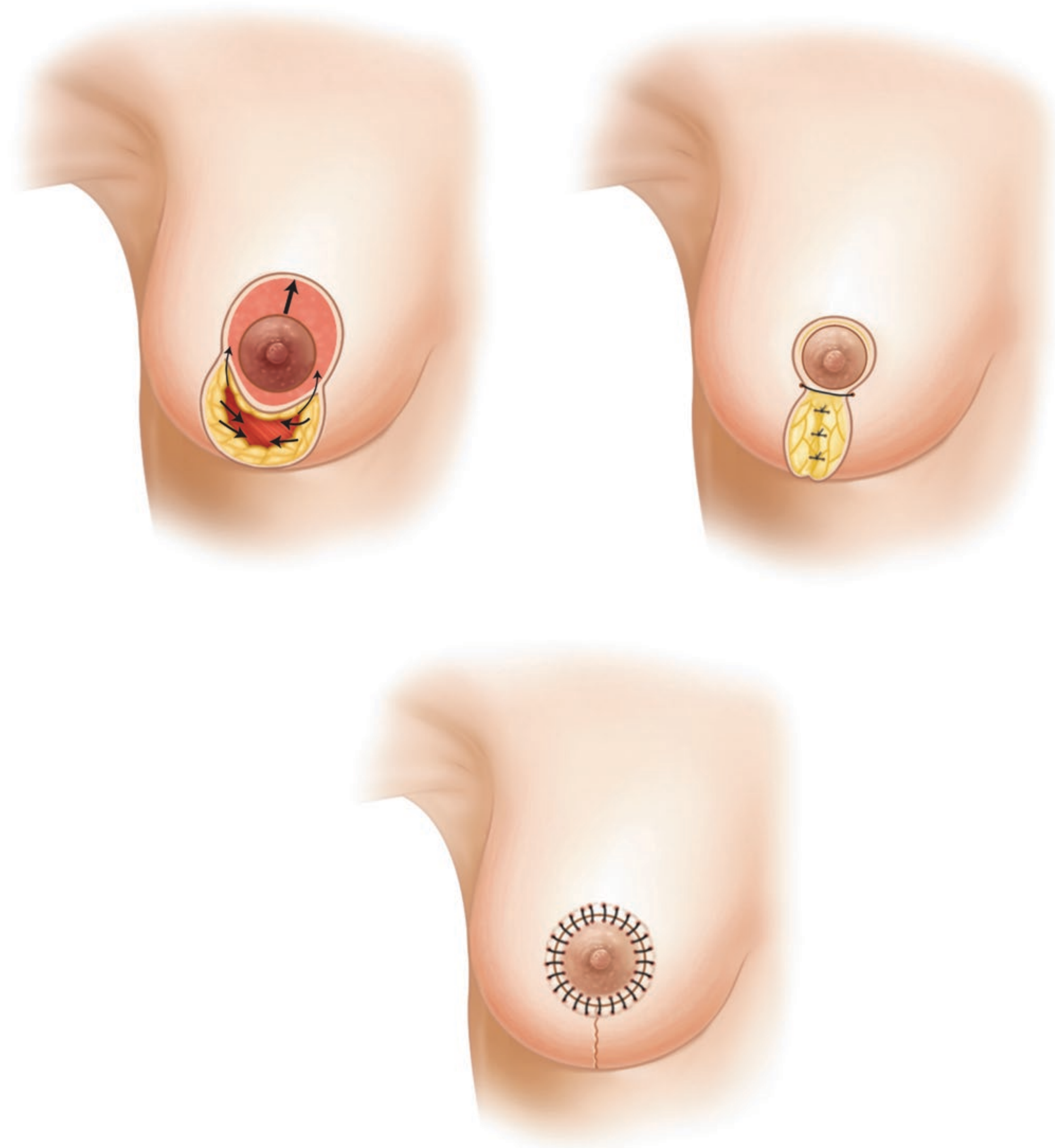


**Fig. 6.45** Reduction mammoplasty; vertical scar technique (Lejour)

## 6.17 Reduction Mammoplasty: Inferior Pedicle Technique

If the inferior pedicle technique of reduction mammoplasty is utilized, then the blood supply to the nipple–areola complex is derived from a pyramid of tissue along the inferior aspect of the breast.

The accompanying illustrations provide an overview of the technique. An inferior pedicle is de-epithelialized from the nipple–areola complex down to the inframammary fold (Fig. 6.46a). The surgeon then sharply divides tissue along the medial and lateral borders of this inferior pedicle and resects tissue medial and lateral to the pedicle (away from the pedicle), as shown in Fig. 6.46b, c. The glandular tissue

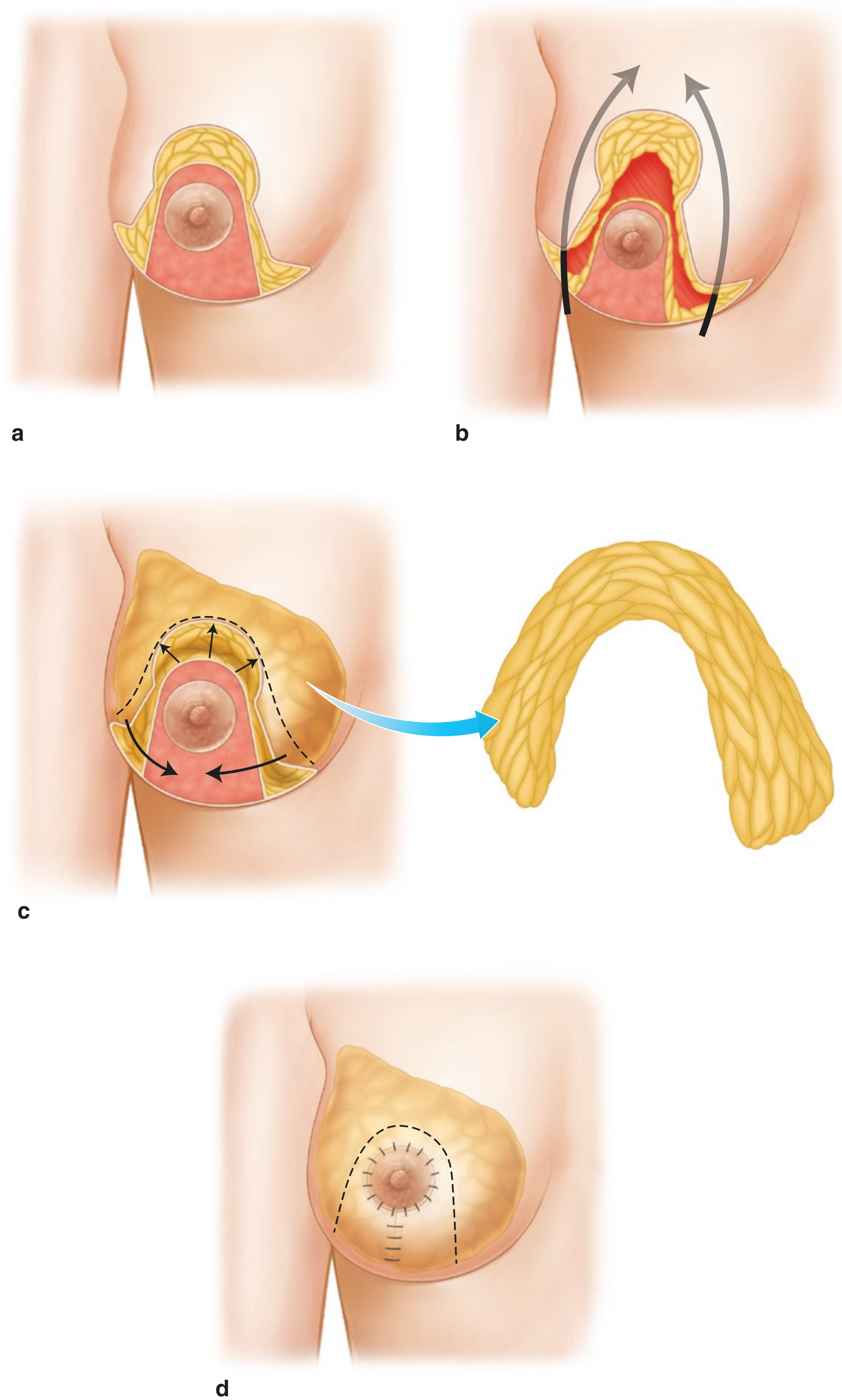



**Fig. 6.46** (**a–d**) Reduction mammoplasty; inferior pedicle technique

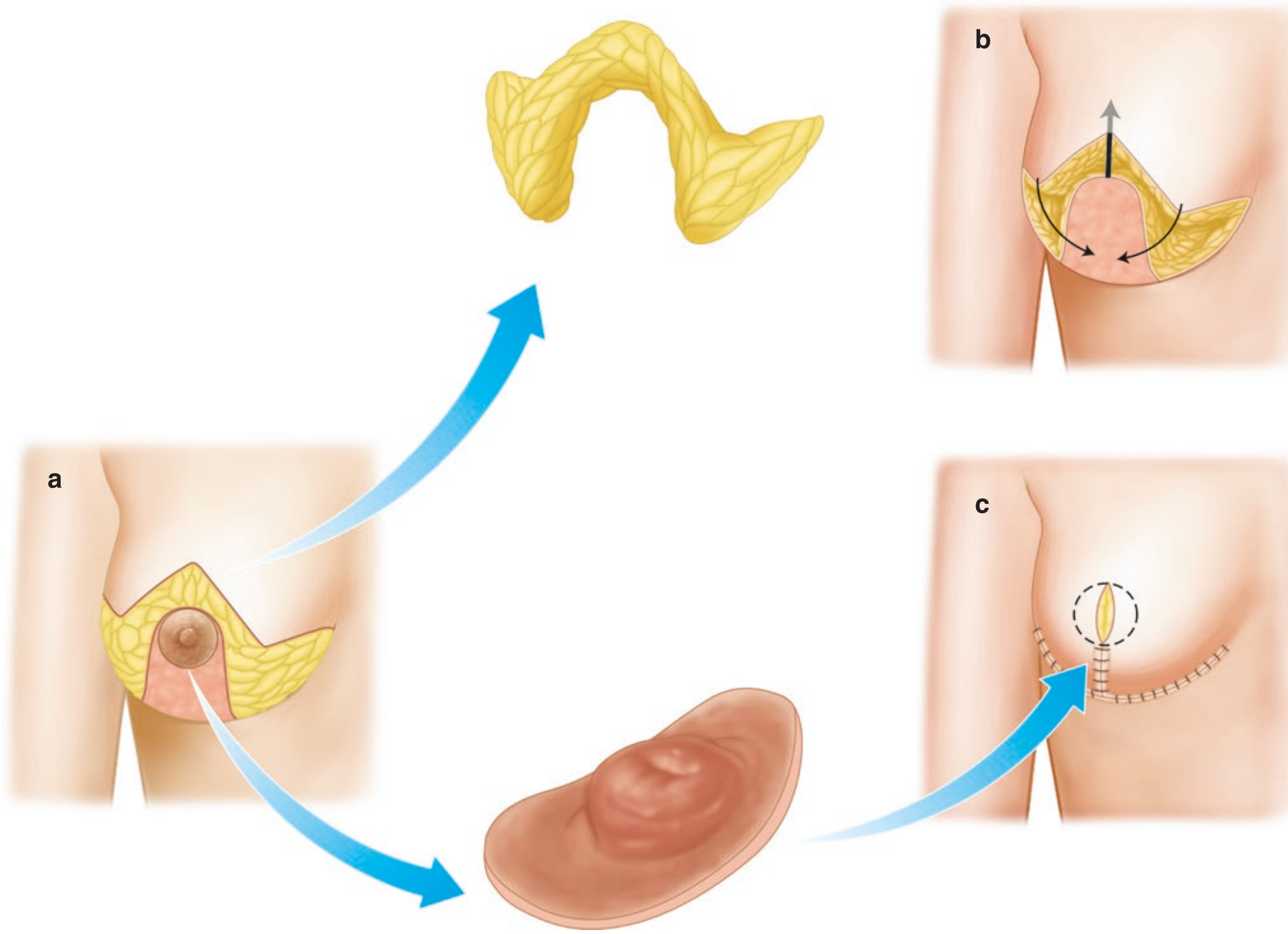



**Fig. 6.47** (**a**–**c**) Reduction mammoplasty inferior pedicle technique with vertical and horizontal scar (Thorek)

is then re-approximated with absorbable sutures, and the medical and lateral flaps are advanced and closed along the inframammary fold (Fig. 6.46d).

The appearance of the resected breast specimen is also shown in the accompanying illustration (Fig. 6.46c).

Reduction mammoplasty utilizing the inferior pedicle technique is further illustrated in Fig. 6.47a–c, utilizing the Thorek technique. These illustrations depict the appearance of the vertical and horizontal scars utilized for the operation and again show the appearance of the accompanying breast specimen that is obtained following the resection (Fig. 6.47b). Also seen is the technique for amputation of the nipple–areola complex and subsequent grafting onto the glandular tissue after complete skin closure (Fig. 6.47c) (Thorek).

## 6.18 Round Block Technique of Reduction Mammoplasty

Figure 6.48 depicts the round block technique for reduction mammoplasty. As shown, a rim of tissue around the nipple–areola complex is de-epithelialized and tissue from the inferior quadrant of the breast is resected. The defect in the inferior quadrant of the breast is then re-approximated with absorbable interrupted sutures.

The de-epithelialized skin around the nipple–areola complex is re-approximated with a running 2–0 monocryl or a nonabsorbable subcuticular stitch. A second purse string suture is done with 4–0 monocryl to close the skin.

The appearance of the resected breast tissue is as shown (Fig. 6.48).

## 6.19 Breast Ptosis Classification

Breast ptosis is defined by the position of the nipple–areola complex relative to the inframammary crease. This classification scheme, developed by Regnault, is illustrated in the accompanying diagrams.

Under normal circumstances the entire breast, including the nipple–areola complex, lies above the level of the inframammary crease (Fig. 6.49a).

In a patient with minor ptosis, the nipple lies at the level of the inframammary crease (Fig. 6.49b).

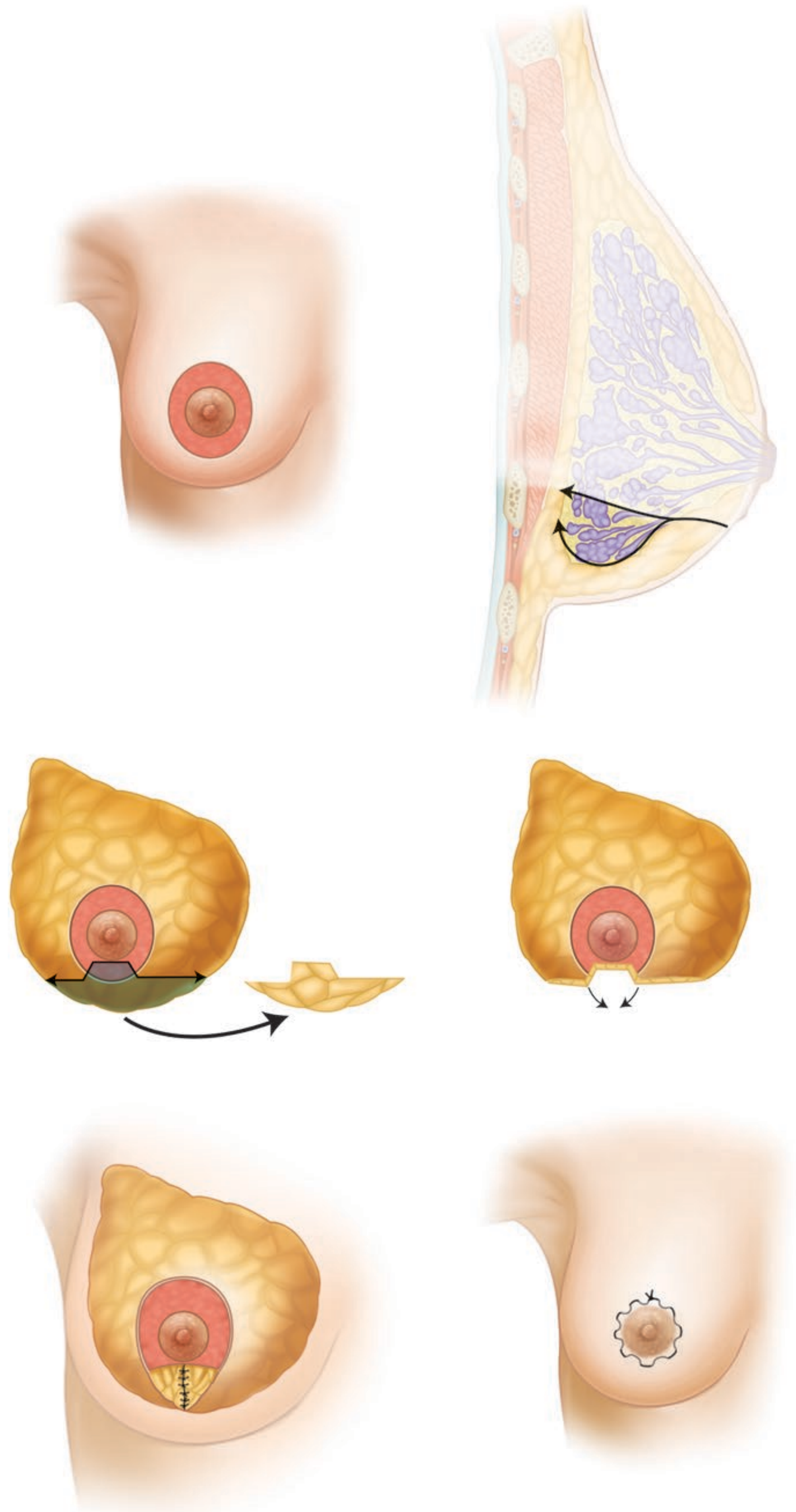


**Fig. 6.48** Round block technique for reduction mammoplasty

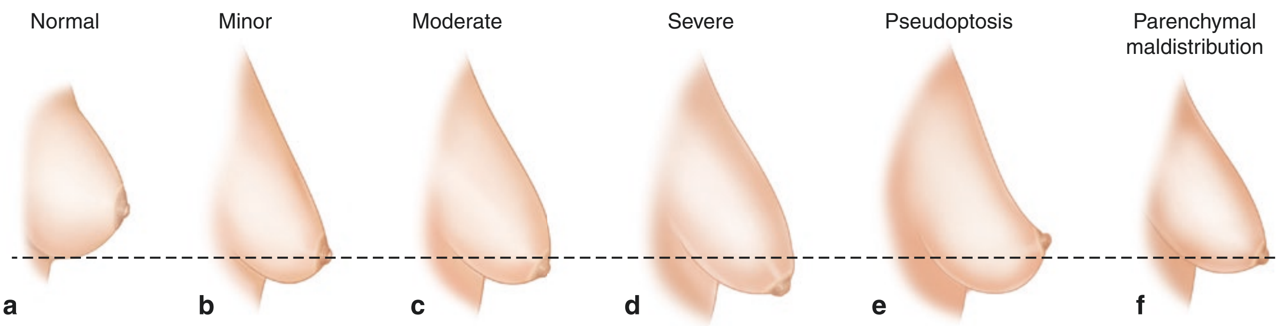



**Fig. 6.49** (**a–f**) Breast ptosis classification

When the nipple lies below the level of the inframammary crease but remains above the lower contour of the breast gland, this is referred to as moderate ptosis (Fig. 6.49c). Finally, in a patient with severe ptosis, the nipple lies below the inframammary crease and along the lower contour of the breast (Fig. 6.49d).

When the nipple lies above the level of the inframammary crease but loose skin droops below the level of the crease, this is referred to as pseudoptosis (Fig. 6.49e).

The term parenchymal maldistribution refers to a situation where the nipple and the lower aspect of the breast droop below the inframammary crease as shown in the accompanying diagram (Fig. 6.49f).

## 6.20 Mastopexy

A mastopexy, otherwise known as a "breast lift," is indicated for correction of more severe forms of ptosis and is described later. When a patient presents with minor ptosis or pseudoptosis, an area cephalad to the nipple–areola complex is de-epithelialized thereby permitting advancement of the latter structure.

Patients who benefit most from mastopexy are generally those with moderate or severe ptosis. Several techniques are available that can correct these degrees of ptosis and are illustrated in the accompanying section.

Mastopexy sometimes involves deep fixation of the breast tissue to the underlying pectoralis major muscle. In this technique, planes of dissection are created both inferiorly and superiorly between the breast and skin. The superior dissection is extended posteriorly for a short distance to create a plane between the breast and pectoralis major muscle. A few stitches are then placed along the superior aspect to fix the breast to the underlying pectoralis major muscle. This serves to lift the breast and improves its projection.

This technique often produces a very good result in the immediate term, but the mastopexy is generally not stable, and long-term results tend not to be maintained.

In the following pages, other techniques for mastopexy are described and illustrated.

## 6.21 Round Block Technique for Mastopexy

Figures 6.50 and 6.51 illustrate the round block technique for mastopexy. Patients presenting with a significant degree of ptosis undergoes periareolar de-epithelialization (Fig. 6.50a). Following this initial maneuver, two options are available. Firstly, a single purse string suture can be inserted thereby bringing the edges of the de-epithelialized zone together (Fig. 6.50b, c). The surface of the breast adjacent to the nipple–areola complex will now appear flattened, giving the appearance of a "tomato shape breast" (Fig. 6.50d). This particular technique is useful for making small corrections to the breast.

Alternatively, the surgeon may elect to transpose a flap of glandular tissue from the lower quadrant to beneath the de-epithelialized periareolar area (Fig. 6.50e, f). The gland is essentially transected to obtain two glandular flaps that cross each other and be fixed to the pectoral fascia in order to reduce the diameter of the base and increase projection of the breast (Fig. 6.50g). The skin edges of the de-epithelialized area are approximated resulting in optimal projection of the breast as illustrated (Fig. 6.50h).

Figure 6.51 demonstrates use of dermal flaps (de-epithelialized skin) to fix the breast to the pectoralis major muscle in a manner somewhat like an internal bra that result in improved projection of the breast. As illustrated, the dermis is undermined, thereby creating a dermal flap which is brought down to the pectoralis major muscle with suturing of the dermal flap to the muscle (Fig. 6.51a, b).

Alternatively, when the dermal flap is relatively short, a semi-absorbable mesh can be used as championed by Goes. One end of the Vicryl mesh is sutured anteriorly to the dermal flap and the other end posteriorly to the pectoralis

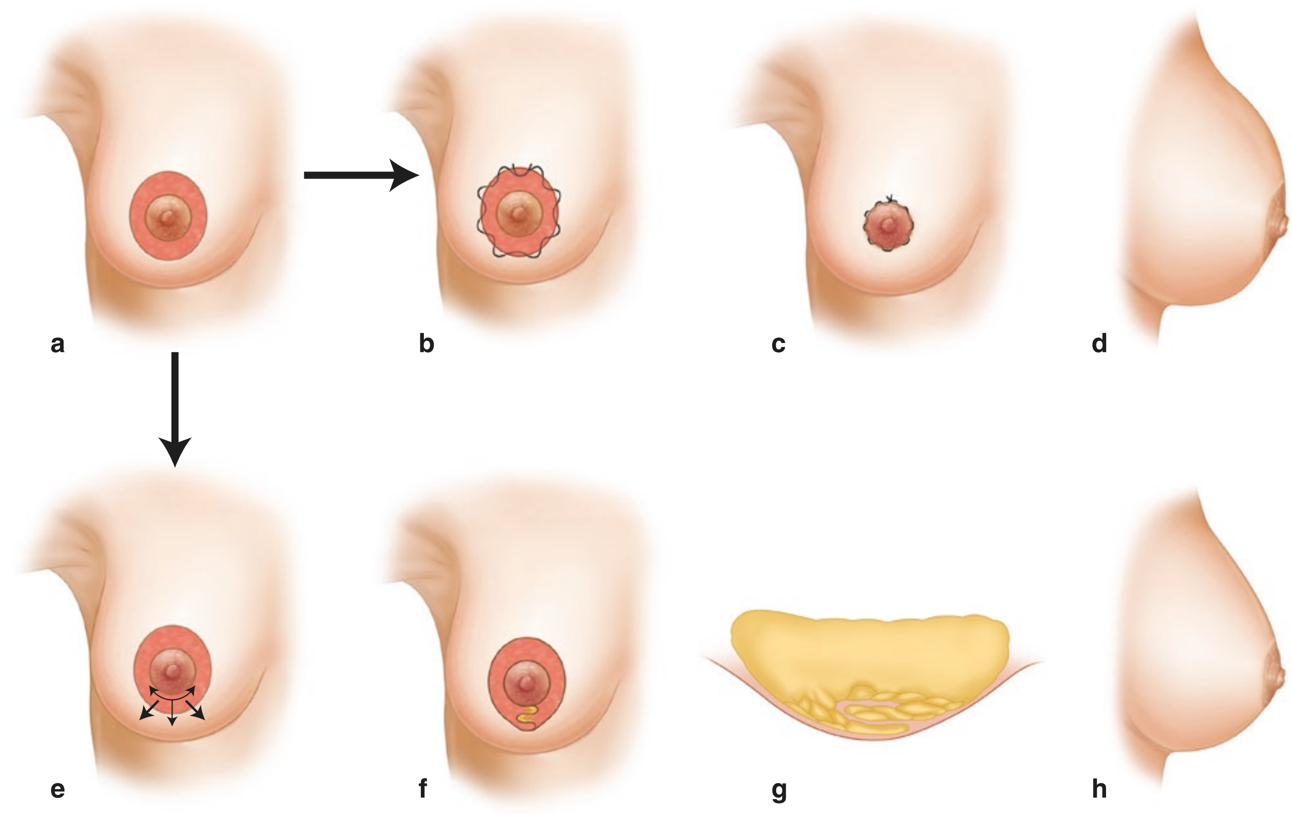



**Fig. 6.50** (**a–h**) Round block technique for mastopexy

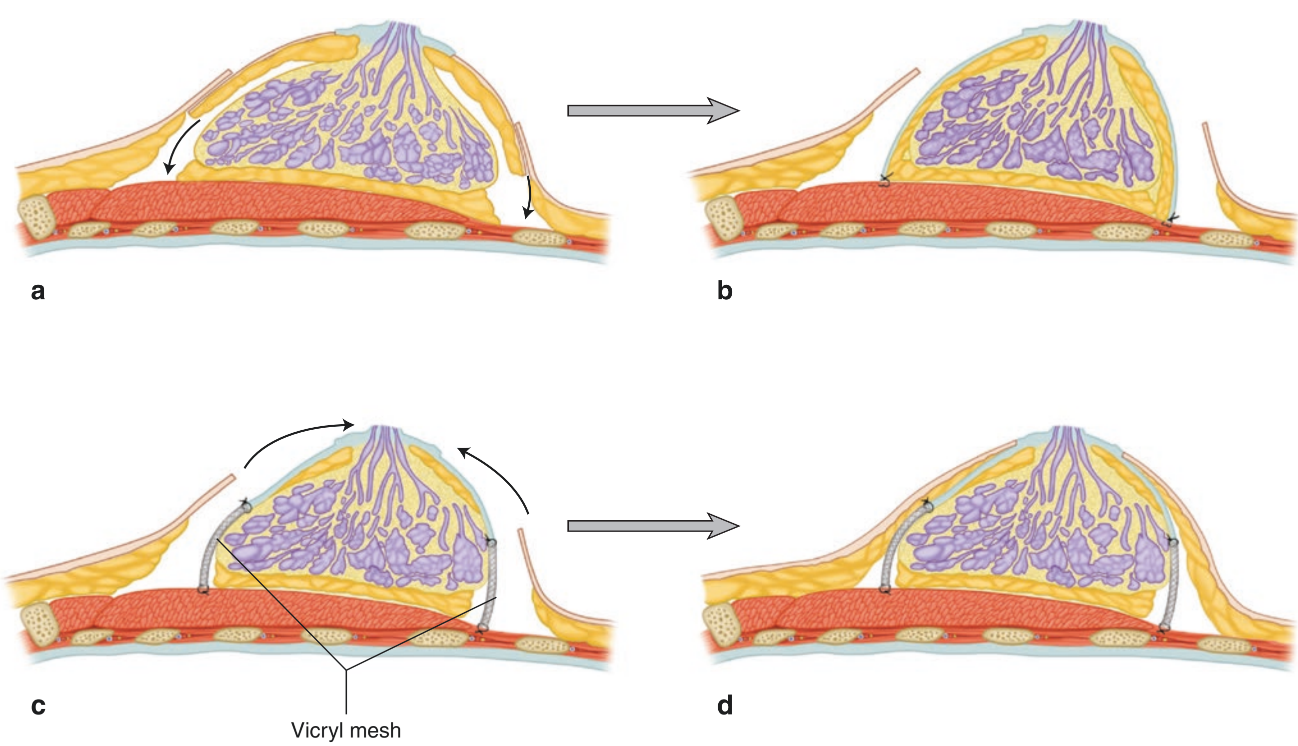



**Fig. 6.51** Round block technique for mastopexy

major muscle (Fig. 6.51c, d). The skin edges are approximated with a 3–0 monocryl subcuticular stitch. The final suture lines are depicted in the accompanying illustration (Fig. 6.51c, d).

## 6.22 Mastopexy: Oblique Technique (DuFourmentel)

This technique involves de-epithelialization of a rim of tissue around the nipple–areola complex (Fig. 6.52). After de-epithelialization, a section of breast tissue is resected inferiorly, and the adjacent breast tissue is undermined. The defect in the breast is then closed with absorbable sutures, and the skin edges are approximated with a 3–0 monocryl subcuticular stitch. In addition, the de-epithelialized area around the nipple–areola complex is approximated with a running absorbable stitch.

## 6.23 Augmentation Mammoplasty

Augmentation mammoplasty is one of the most common cosmetic procedures performed by plastic surgeons. The procedure is popular among women of all ages, and the following illustrations provide a brief overview of the various procedures.

There are basically three surgical approaches to augmentation mammoplasty axillary, periareolar, and inframammary fold (Fig. 6.53a–c). As shown, these each allow the surgeon to create a plane between the breast and the anterior aspect of the pectoralis major muscle or, alternatively, between the posterior aspect of the muscle and the chest wall.

Figure 6.54 shows how the prosthesis for augmentation mammoplasty can be placed in either a submammary or subpectoral location. Varying degrees of subpectoral dissection can be performed within this range of anatomic implant location, based on the desired amount of nipple-areola complex (NAC) elevation with the final outcome (Fig. 6.55). The most common type of subpectoral augmentation involves inferior dis-insertion of the muscle off the 6th–8th ribs, thus creating a larger submuscular pocket for the implant. This is termed a type 1 dual-plane augmentation. With a type 2 dual-plane placement, the muscle is similarly dis-inserted off the ribs but is also separated from the breast parenchyma on its anterior surface, up to the level of the NAC. This permits a degree of NAC elevation in those cases where there is mild preoperative ptosis. For augmentation of breasts with moderate preoperative ptosis, a type 3 dual-plane augmentation can be performed. This involves more extensive separation of the muscle from the breast parenchyma along its anterior surface following inferior dis-insertion. This facilitates more pronounced elevation of the NAC with augmentation.

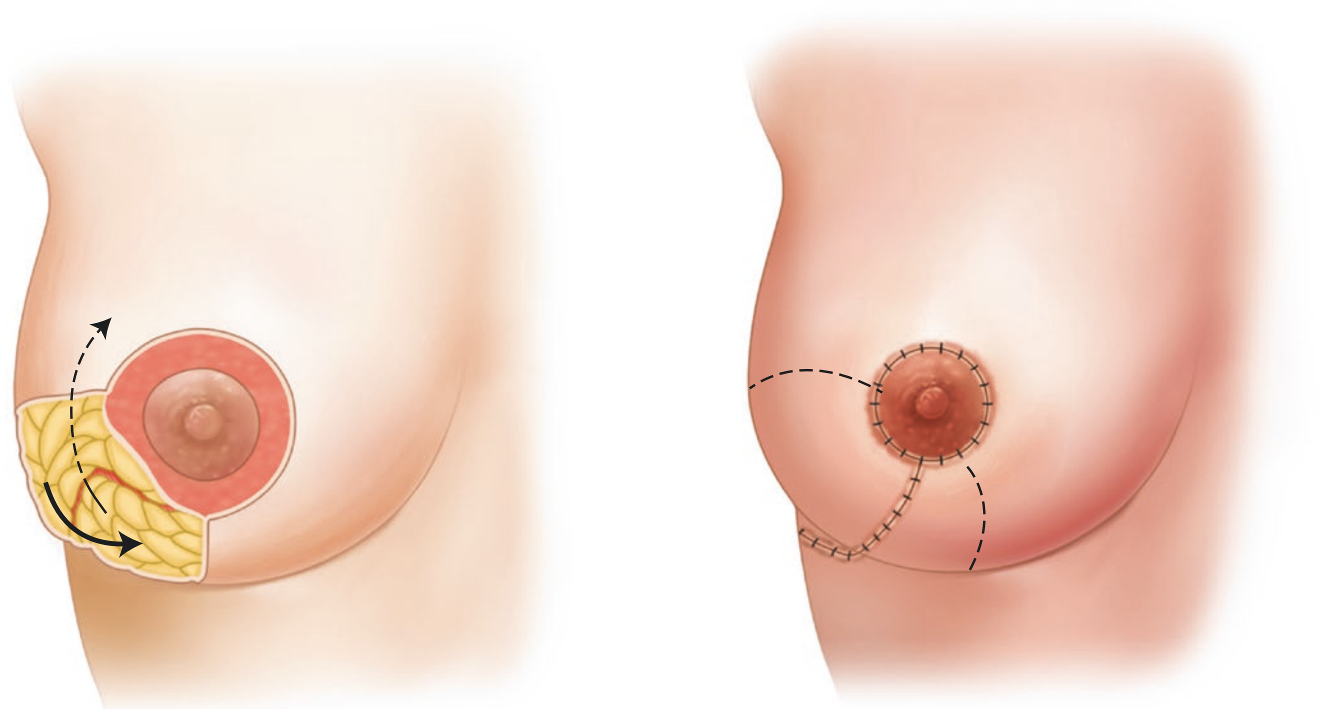


**Fig. 6.52** Mastopexy; oblique technique (DuFourmentel)

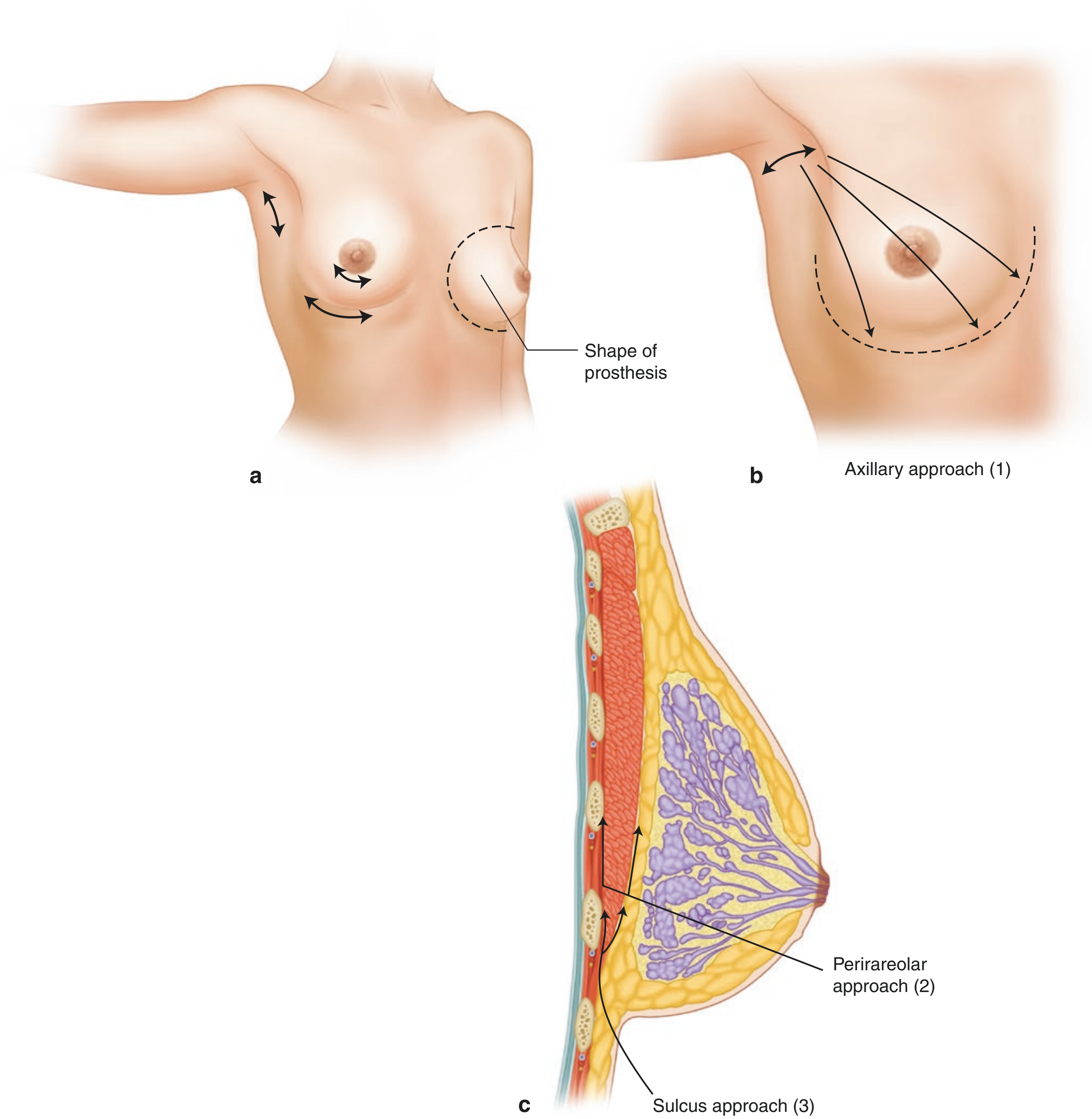



**Fig. 6.53** (**a–c**) Surgical approaches for augmentation mammoplasty

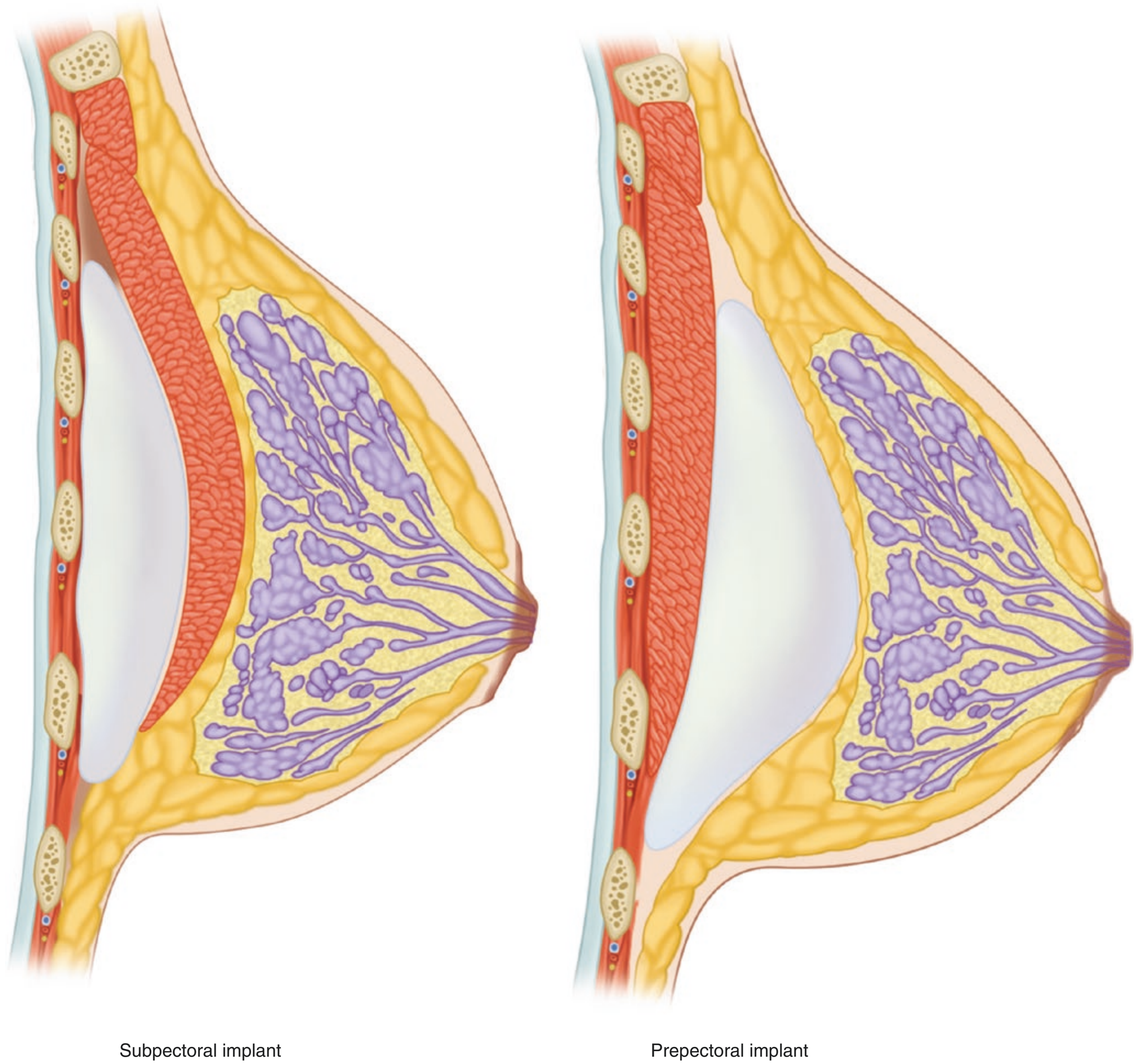



**Fig. 6.54** Augmentation mammoplasty

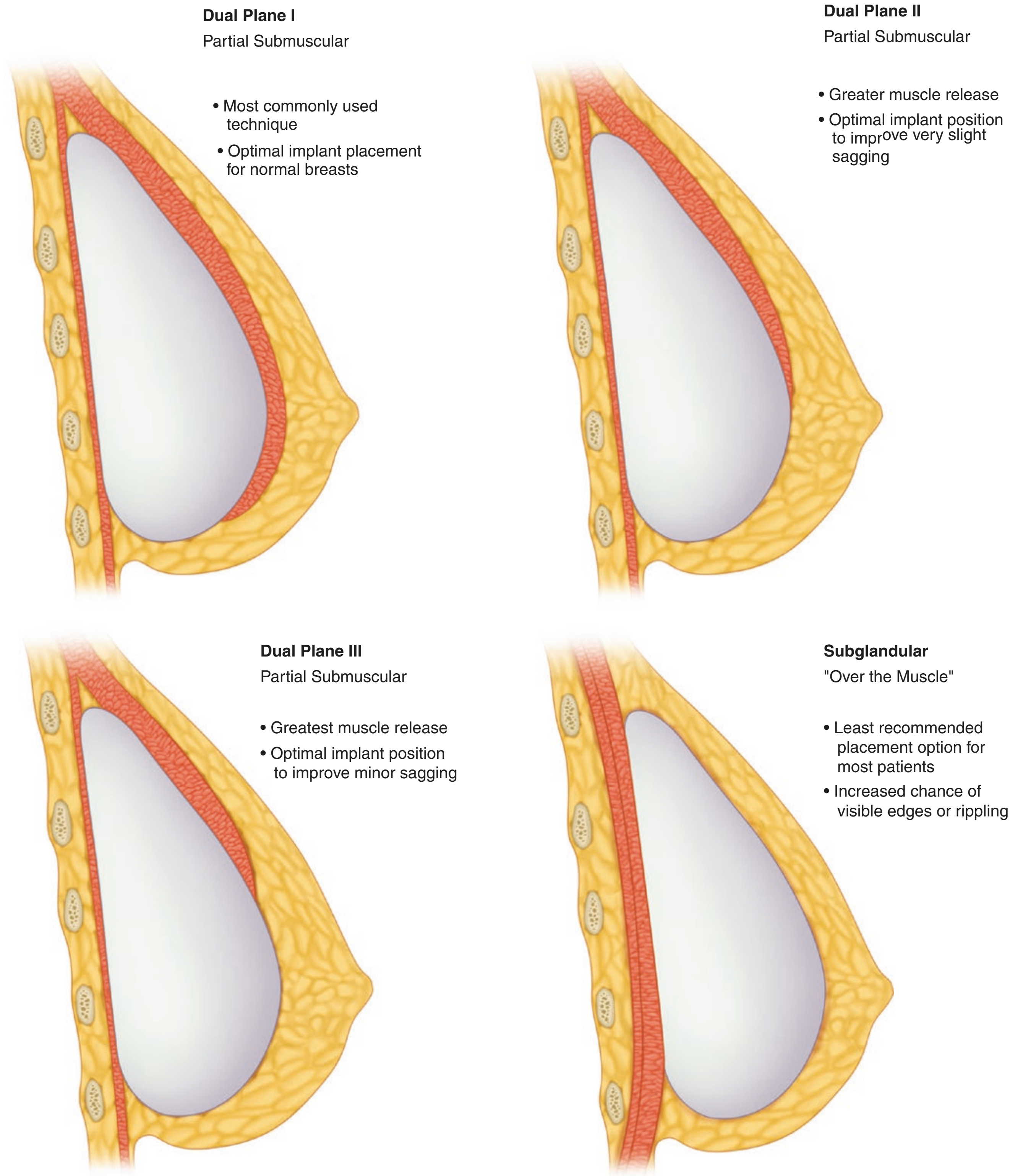



**Fig. 6.55** Illustration of various degrees of dual-plane augmentation, based on ranges of separation of pectoralis major muscle from overlying breast parenchyma, at time of augmentation

As depicted in Fig. 6.56, patients with breast asymmetry may elect to undergo augmentation mammoplasty, whereby the prosthesis is usually placed in the submammary position (anterior to the pectoralis major muscle).

## 6.24 Nipple Plasty for Inverted Nipple

The technique of nipple plasty for inverted nipple is illustrated in Fig. 6.57. The procedure begins with a curvilinear incision adjacent to the inverted nipple (Fig. 6.57b). The dissection is then continued posteriorly as shown, so that the inverted nipple can be lifted up with a skin hook (Fig. 6.57c). An absorbable stitch is then placed around the nipple after elevation, and this is securely tied down (Fig. 6.57d).

A plastic syringe that has been cut is then placed over the nipple. As illustrated, a 3–0 Prolene stitch is then placed on each side of the cut syringe. These extend from the nipple, through the plastic syringe, and are then tied down onto the skin (Fig. 6.57e). In this way, the nipple that has been re-inverted is secured and maintained in this position for about 10 days until the wounds have healed.

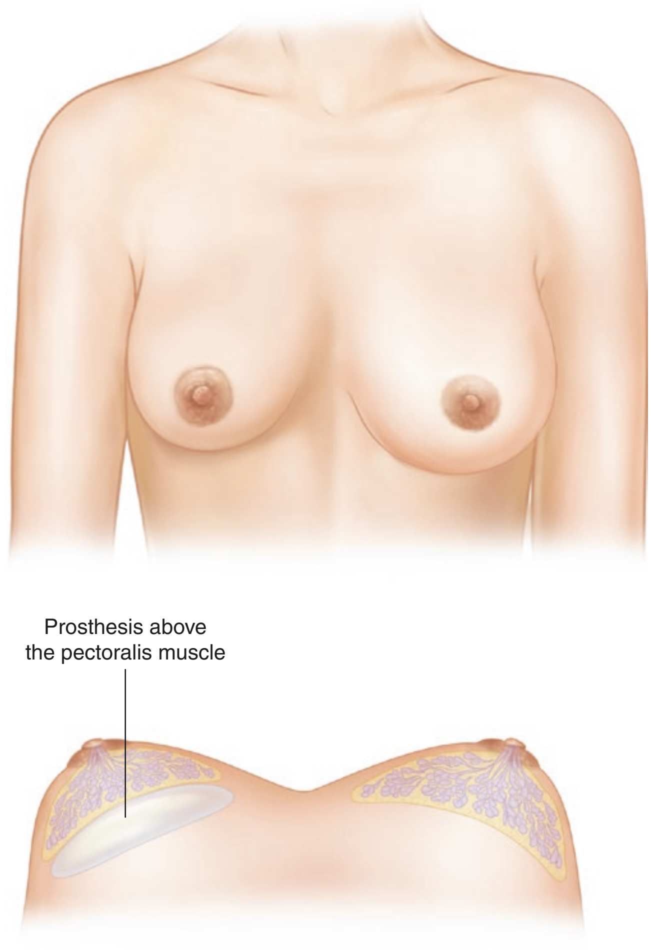



**Fig. 6.56** Augmentation mammoplasty for breast asymmetry

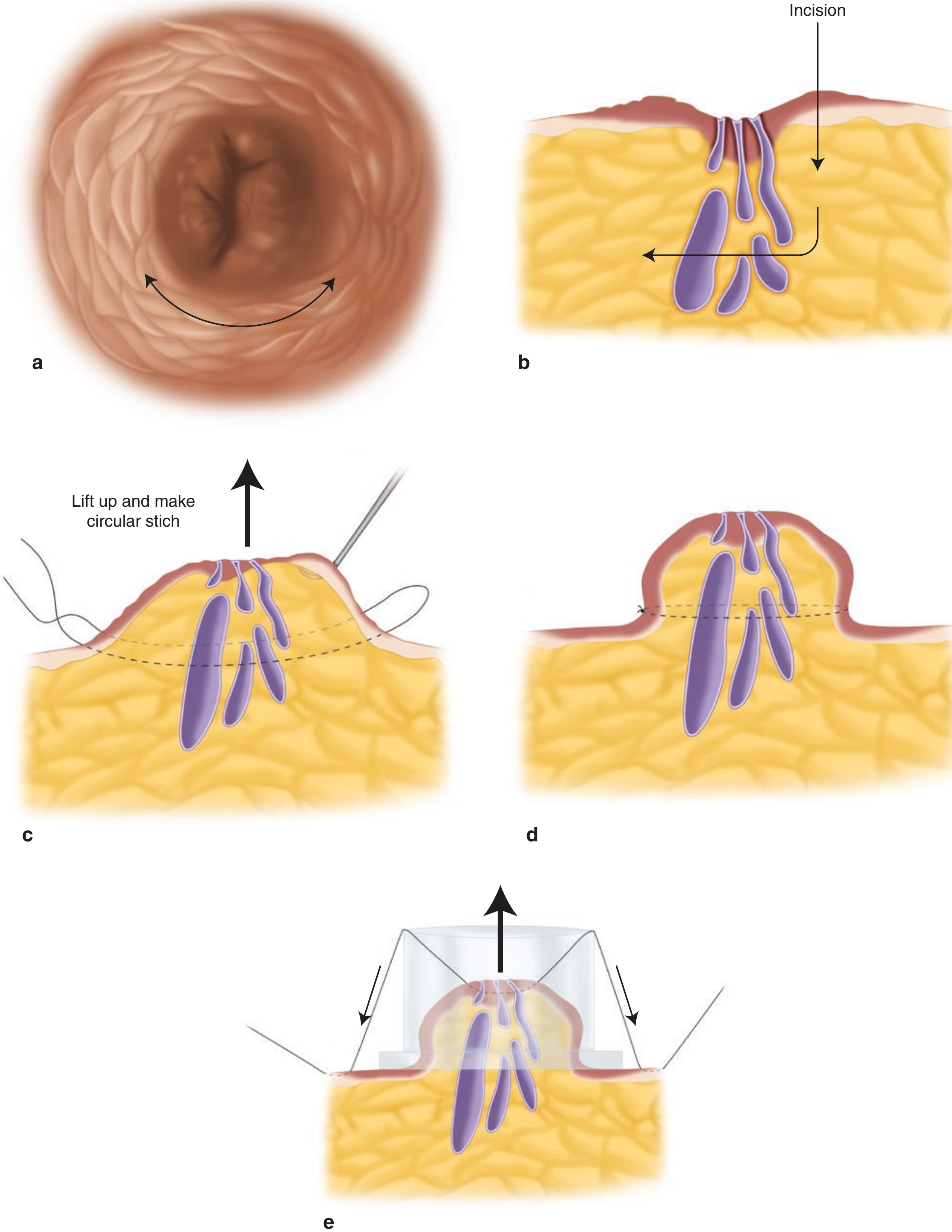



**Fig. 6.57** Nipple plasty for inverted nipple

## Further Reading

1. Wang F, Peled AW, Garwood E, Fiscalini AS, Sbitany H, Foster RD, Alvarado M, Ewing C, Hwang ES, Esserman LJ. Total skin-sparing mastectomy and immediate breast reconstruction: an evolution of technique and assessment of outcomes. Ann Surg Oncol. 2014;21(10):3223–30.
2. Sbitany H, Sandeen SN, Amalfi AN, Davenport MS, Langstein HN. Acellular dermis-assisted prosthetic breast reconstruction versus complete submuscular coverage: a head-to-head comparison of outcomes. Plast Reconstr Surg. 2009;124(6):1735–40.
3. Sbitany H, Piper M, Lentz R. Prepectoral breast reconstruction: a safe alternative to submuscular prosthetic reconstruction following nipple-sparing mastectomy. Plast Reconstr Surg. 2017;140(3):432–43.
4. Sbitany H, Wang F, Peled AW, Lentz R, Alvarado M, Ewing CA, Esserman LJ, Fowble B, Foster RD. Immediate implant-based breast reconstruction following total skin-sparing mastectomy: defining the risk of preoperative and postoperative radiation therapy for surgical outcomes. Plast Reconstr Surg. 2014;134(3):396–404.
5. Delay E, Gounot N, Bouillot A, Zlatoff P, Rivoire M. Autologous latissimus breast reconstruction: a 3-year clinical experience with 100 patients. Plast Reconstr Surg. 1998;102(5):1461–78.
6. Coleman DJ, Sharpe DT, Naylor IL, Chander CL, Cross SE. The role of the contractile fibroblast in the capsules around tissue expanders and implants. Br J Plastic Surg. 1993;46:547–56.
7. Rietjens M, Garusi C, Lanfrey E, Petit JY. Cutaneous suspension: immediate breast reconstruction with abdominal cutaneous advancement using a non-resorptive mesh. Preliminary results and report of 28 cases. [French]. Ann Chir Plast Esthet. 1997;42(2):177–82.