Autologous Latissimus Dorsi Breast Reconstruction

27

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27.1 Introduction

Breast reconstruction belongs to the treatment of breast cancer. An increasing number of patients benefit from immediate or delayed reconstruction. We use autologous tissue [1, 2] because it provides excellent and long-standing results (shape, consistency, sensitivity, integration in the body image).

The musculocutaneous latissimus dorsi flap was first described by Tansini [3] in 1906 for reconstruction of the chest wall after breast amputation. Under the influence of Halsted, who was hostile to plastic surgery, coverage or reconstruction using this flap fell into disuse. Rediscovered in 1976 by Olivari, the latissimus dorsi flap had become a major option in breast reconstruction by the end of the 1970s [4]. From the 1980s onward, various authors proposed using the latissimus dorsi as an autologous flap [5, 6] but this technique had few indications because the results were unsatisfactory and the dorsal sequelae were considered to be too marked. Since 1993, we have been using the technique of autologous latissimus dorsi breast reconstruction as described in our 1998 article [7]. As our experience increased and we evaluated our intensive practice of breast reconstruction (personal experience of more 100 reconstructions a year), our preference moved to autologous latissimus dorsi reconstruction, which is now our principal technique. However, the volume of the reconstructed breast may be insufficient if the patient is very slim or if there is marked atrophy of the flap. The classic solution in such cases was secondary insertion of an implant under the flap. Of course, the reconstruction was then no longer purely autologous, which had its own disadvantages, and the new breast was of less natural shape. The development in our department and use since 1998 of lipomodeling of the reconstructed breast [1, 2], which has many advantages and ideally completes autologous latissimus dorsi reconstruction, probably contributed to the predominant use of this flap.

In this chapter, we present our technique and its recent advances, the means of obtaining an autologous reconstruction, the indications and contraindications, the possible complications, the results which may be expected, and lastly the advantages and drawbacks of autologous latissimus dorsi breast reconstruction.

27.2 Surgical Anatomy of the Autologous Latissimus Dorsi Flap

27.2.1 The Latissimus Dorsi Muscle

The latissimus dorsi is a thin and wide muscle. It inserts anteriorly on the lower four ribs, where four attachments converge with the digitations of the obliquus externus abdominis. The medial and lower part of the muscle inserts on the thoracolumbar fascia, which extends over the spinous processes of the lower six thoracic vertebrae, the five lumbar vertebrae, the sacral vertebrae, and the posterior third of the iliac crest. Its upper border covers the inferior angle of the scapula, where an accessory bundle of teres major is often observed. Together with the latter, it defines the posterior wall of the axilla before ending its insertion at the bicipital groove of the humerus between the pectoralis major and the teres major tendons. Its deep aspect carries attachments which are common to the latissimus dorsi and serratus anterior.

The vascular supply to the latissimus dorsi is a type V in the classification of Mathes and Nahai, with a main thoracodorsal pedicle and accessory segmental pedicles arising from the intercostal and lumbar arteries. When the thoracodorsal pedicle penetrates in the deep aspect of the latissimus dorsi, it divides into two branches of equal importance: the descending branch and the transverse

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Fig. 27.1 Surgical procedure. **a** Preoperative thoracic wall preoperative marking. **b** Skin paddle and different fat pads harvested with the autologous latissimus dorsi flap (preoperative rear view). **c** Skin paddle and different fat pads harvested with the autologous latissimus dorsi flap (preoperative oblique view). **d** Patient in the lateral decubitus position for harvesting the latissimus dorsi flap. **e** Skin paddle incision. **f** Undermining in an upward direction in the plane of the fascia superficialis. **g** Elevation of the scapular fat flap (zone 3). **h** Coagulation of the accessory segmental pedicles using bipolar forceps. **i** Dissection of the pedicle. **j** Autologous latissimus dorsi flap harvested. **k** Result at the end of the procedure after total burial of the flap. **l** Postoperative oblique view

branch. The motor nerve of the latissimus dorsi arises from the thoracodorsal nerve originating from the posterior secondary trunk C6–C8. Its origin is about 3 cm more internal than the vascular pedicle, which it then rejoins before penetrating the muscle, except in cases in which the origin of the artery is more proximal, with the nerve lying between the artery and the vein.

The latissimus dorsi allows adduction, backward movement, and internal rotation of the arm. It is therefore involved in weight-bearing movements such as walking

with crutches, and in vertical traction with the arms raised above the head. Its removal has little effect on daily life or the practice of amateur sports, but its lack is more greatly felt in cross-country skiing and particularly in rock-climbing.

27.2.2 The Fatty Extensions of the Latissimus Dorsi Muscle

The autologous latissimus dorsi flap aims to increase the volume provided by the latissimus dorsi by incorporating fatty areas which are true extensions to the flap (Fig. 27.1a–c), because the muscle atrophies after transfer when it is no longer used. We have described six fatty areas [1] which are harvested as a complement to the muscle itself:

- Zone 1 corresponds to the fatty area of the crescent of the dorsal skin paddle.
- Zone 2 represents the deep layer of fat lying between the muscle and the fascia superficialis, and is left adherent over all the surface of the flap.
- Zone 3 consists of the scapular hinge flap, which continues on the upper margin of the muscle.
- Zone 4 lies just forward to its external margin, forming an anterior hinge flap.
- Zone 5 corresponds to the suprailiac fat deposits or "love handles."
- Zone 6 is the adipose tissue of the deep aspect of the muscle.

The amount of fatty tissue gained depends on the extent of the patient's fat deposits.

These zones are reliably vascularized by muscular perforating pedicles. Zone 3 has the advantage of a vascular plexus between the cutaneous branches (vertical branch of the circumflex scapular artery, intercostal branch, lateral thoracic branch) and two perforating pedicles of the thoracodorsal artery which anastomose between themselves.

27.3 Objectives of Breast Reconstruction

Both objectives of breast reconstruction are clear:

- To restore the skin, shape, volume, and consistency of the reconstructed breast
- To reestablish the symmetry and harmony of the two breasts.

From a technical viewpoint, the breast requires restoration of the container, or skin envelope, which must be recreated, and the content, or volume, which must be provided. In a second stage, 2 or 3 months later, when the reconstructed breast has found its new volume after atrophy of the muscle, it will be time to consider creating breast symmetry, when the nipple–areola complex is reconstructed.

27.4 Indications/Contraindications

The latissimus dorsi is the flap of choice because reconstruction with this muscle it is a safe and reliable technique. It can be used in the vast majority of clinical situations. Whether the patient is slim or overweight, her morphology is not in itself a contraindication to use of this technique. It can be used in delayed or immediate breast reconstruction. It can also be used even in an adjuvant radiotherapy context.

Contraindications are very rare: a lesion of both the latissimus dorsi pedicle and the serratus anterior pedicle, or a congenital absence of the latissimus dorsi. It is important to check for the existence of a muscular contraction by the resisted adduction test to ensure the presence of a functional latissimus dorsi with a preserved motor nerve. The preservation of the nerve is almost invariably accompanied by a patent thoracodorsal pedicle. Relative contraindications of the flap are dorsal pathologic abnormalities (scoliosis, chronic rachis wounds) and when patient refuses a scar in the back.

27.5 Surgical Procedure

27.5.1 Preoperative Planning

Preoperative assessment takes into account all data obtained during a visit prior to the procedure. Particular attention should be paid to the function of the latissimus dorsi [1], which if good generally indicates that the thoracodorsal pedicle is intact. Some items are important: skin and fat that can be harvested in the laterodorsal region, and assessing dorsal adiposity by pinching the natural laterodorsal pad. The volume obtainable should be compared with the desired volume of the breast. If the estimated volume, after atrophy of the muscle, is inadequate when compared with the volume of the opposite breast, secondary lipomodeling should be included in the operative planning. Patients are informed that there will be a horizontal, curved dorsal scar. More and more in delayed reconstruction, the thoracic scar from the mastectomy continues to a dorsal scar to decrease length of this scar.

27.5.2 Design

The reconstruction is designed (Fig. 27.1a) with the patient in a standing position [1]. She is asked to lean the bust

sideways (Fig. 27.1b, c) in order to reveal the natural folds of the skin and fat. The dorsal skin paddle follows these lines, forming a crescent with a concave upper curve (Fig. 27.1c). The amount of skin available should be carefully assessed using the pinch test so that closure can be performed entirely free from tension. The medial extremity of the paddle lies between the inferior angle of the scapula and the spine, whereas the lateral extremity may extend a few centimeters beyond the anterior margin of the muscle, depending on the patient's morphology. In delayed reconstructions with an important previous subaxillary dog ear from the mastectomy, it is useful to integrate the dog ear into the flap, to avoid a bigger dog ear after the abdominal advancement flap.

27.5.3 Surgical Technique

The patient is placed in a lateral decubitus position (Fig. 27.1d), with the arm in abduction to open the axillary hollow. Physiological saline infiltration is done in the dorsal area. This makes dissection under the fascia superficialis easier by making it more visible. The skin paddle is incised by a single cut down to the fascia superficialis (Fig. 27.1e, f). Dissection then follows the deep aspect of the fascia superficialis, taking care to leave the deep fat on the muscle (zone 2). The upper part of the undermined area reaches the inferior angle of the scapula. In the internal part, the fascia superficialis is undermined up to the trapezius. The whole area of fatty tissue (Fig. 27.1g) between the superior border of the latissimus dorsi, the trapezius, and the upper limit of undermining forms the surface of the scapular hinge flap (zone 3). Then, the flap is harvested with respect to the trapezius, teres major and rhomboid muscle. The cutaneous prolongation of the circumflex scapular pedicle should be carefully ligated. In the lower part, undermining should be a little wider than in the area of the latissimus dorsi to make it easier to release the muscle later. The lower limit lies a little above the iliac crests in order to harvest fat from the love handles (zone 5). In the medial part, the cutaneous perforators of the intercostal posterior arteries that lie above the transverse processes mark the limit. In the lateral part, dissection begins a few centimeters forward of the anterior margin of the latissimus dorsi in order to harvest fat in zone 4. The muscle is then separated at a deep level from the serratus anterior by starting at about 15 cm from the axilla, because dissection is easy there [1]. Submuscular undermining is continued by harvesting the deep fat (zone 6) and by carefully ligating or coagulating the accessory pedicles (Fig. 27.1h). When the latissimus dorsi has been completely undermined, its distal part is transected, from the deep part toward the surface, as horizontally as possible in order to include as much fat bulk as possible, in particular zone 5 of the flap. In the axillary region, the pedicle is then freed so that it can be transposed without tension or kinking, and the latissimus dorsi tendon is sectioned. The pedicle is approached posteriorly by releasing the teres major from the latissimus dorsi, in a distal to proximal direction. The origin of the latissimus dorsi pedicle (Fig. 27.1i) is identified by following the pedicle of the serratus anterior up to the Y-shaped bifurcation. The branch of the serratus anterior should be carefully preserved to ensure blood supply to the flap if there is a lesion of the thoracodorsal pedicle. To make flap transposition easier, the scapular angular artery is ligated. When the pedicle has been identified, a finger is passed under the tendon (between the pedicle and the tendon) to protect it during partial proximal section of the tendon. The flap is then ready (Fig. 27.1j) to be transposed to the breast area via a subcutaneous tunnel or directly if the thoracic/dorsal scar is to be continued. The donor site [8] is closed (quilting suture) after irrigation of the whole area of the undermining in order to obtain perfect hemostasis (one suction drain).

27.5.4 Positioning and Modeling of the Flap

Positioning and modeling of the flap differ according to two situations: delayed breast reconstruction and immediate breast reconstruction.

27.5.4.1 Delayed Reconstruction

To meet our objectives, in most cases we try to limit or rather to avoid using dorsal skin on the breast. The skin of the breast is reconstructed with adjacent skin from a thoracoabdominal advancement flap [9]. The flap is then placed in position in the newly created breast pocket. After it has been ensured that closure is possible without excessive tension, the decision is taken to totally bury the flap, and the skin is then entirely excised with removal of the dermis (dedermization). The flap is then modeled very simply by placing zone 1, with the dermis removed, in a vertical position oriented along the mammary axis, without folding or the need for any particular modeling (it is the cutaneous compartment which gives the breast its shape). Two suction drains are inserted and then closure is performed in two planes (Fig. 27.1k, l).

27.5.4.2 Immediate Reconstruction

We usually reserve immediate reconstruction for patients who will not receive complementary radiotherapy.

Modeling is begun by recreating the limits of the normal breast compartment. The inframammary fold and its axillary extension are the most important to recreate. The flap is secured at the upper limits of the mastectomy area by two absorbable sutures. The distal part of the muscle and its

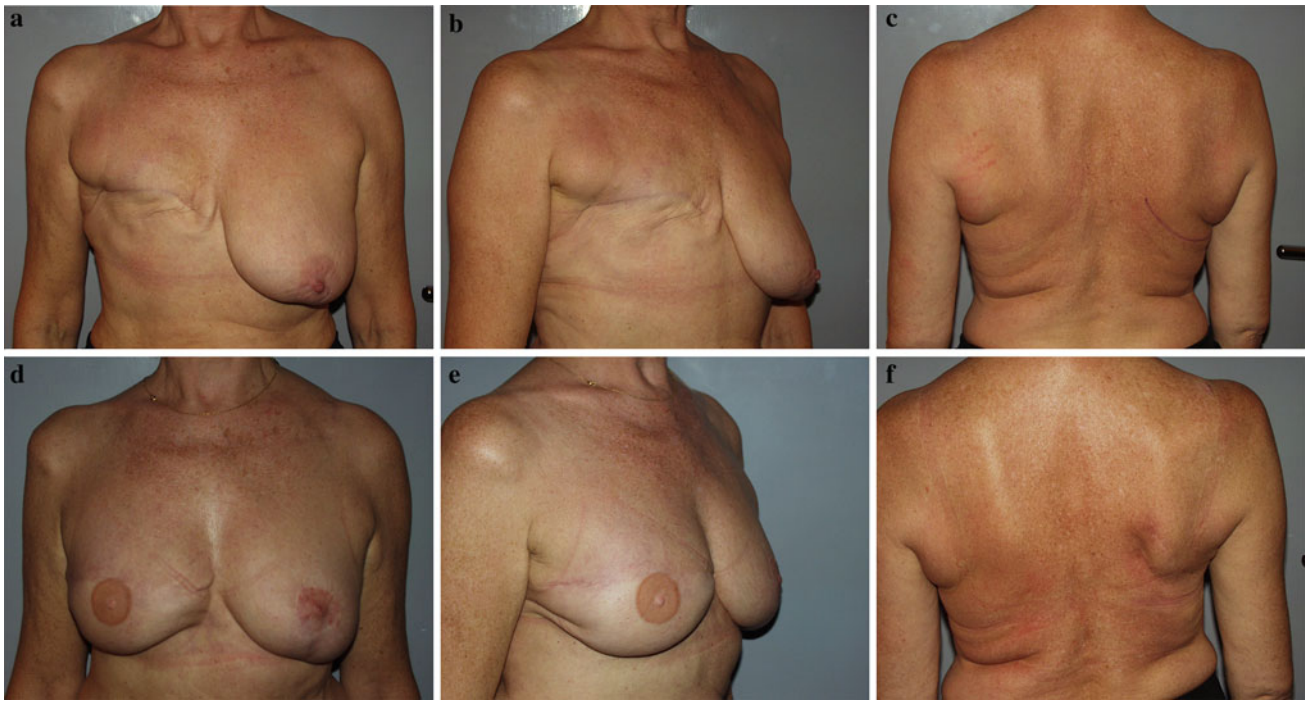

Fig. 27.2 Patient aged 61 years. Breast implant failure. Delayed right breast reconstruction combining an autologous latissimus dorsi flap with an abdominal advancement flap. Left breast mastopexy. Result at 12 months. **a** Preoperative frontal view, **b** preoperative oblique view, **c** preoperative rear view, **d** postoperative frontal view, **e** postoperative oblique view, and **f** postoperative rear view

underlying fat are folded under the breast mound to increase volume and projection. After the latissimus dorsi flap has been placed in position, the skin paddle is brought out through the mastectomy incision. It is shaped like an asymmetrical U and is sutured in that position. At the apex of this cone, two rectangular dermal-fat flaps with a central pedicle of about 2 cm × 1 cm (for a medium-sized nipple) are raised. The dorsal skin paddle (with its anterior extremity detached from the muscle for 3–4 cm) is folded above the areola to form a cone. As the position of the areola is predefined and since secondary nipple reconstruction using local flaps or composite nipple grafts is known to give disappointing results with flat nipples lacking projection, we tend to reconstruct the nipple at the same time as the breast. We reconstruct the nipple using the skin paddle of the latissimus dorsi flap (Fig. 27.4d, e). As previously described, a bifoliate design is used and the skin flaps are rolled around each other, recreating the nipple [10]. The reconstructed breast must be larger than the expected final result and the nipple–areola complex must be 1 cm higher at the end of the procedure [11]. Since 2007, to reduce operating time and avoid changing positions, we try to do all the modeling with the patient in the lateral decubitus position. But we finish the procedure with the patient in the lateral position and do the dorsal dressing. The patient is put in a sitting position to check the shape of the reconstructed breast: if the result is good, the procedure is finished; if it is not, we reopen the reconstructed breast to improve the modeling. This approach saves 30 min of operating time, and is useful for the very experienced surgeon.

27.6 Results

The results of breast reconstruction with the autologous latissimus dorsi flap were first evaluated in 1998, followed by a study of 400 cases in 2001. The assessment of the results by both patients and surgeons showed a very high satisfaction rate of 97 % (evaluated as very good in 87 % of cases by the surgeons and in 85 % of cases by the patients, good in 10 % of cases by the surgeons and in 12 % of cases by the patients). In no case was the reconstruction considered a failure. Residual scarring of the back was considered minimal by 96 % of patients, and moderate by 4 %. In addition to the satisfactory morphological result, autologous latissimus dorsi breast reconstruction enabled patients to better integrate their new body image and to feel more feminine, in particular because of the sensitive [12], supple, warm, and natural feeling of the flap. Lipomodeling also improves perception of the flap, by making it supple enough to recover the consistency of a natural breast.

We present some clinical cases with long-standing results in Figs. 27.2, 27.3, 27.4 and 27.5.

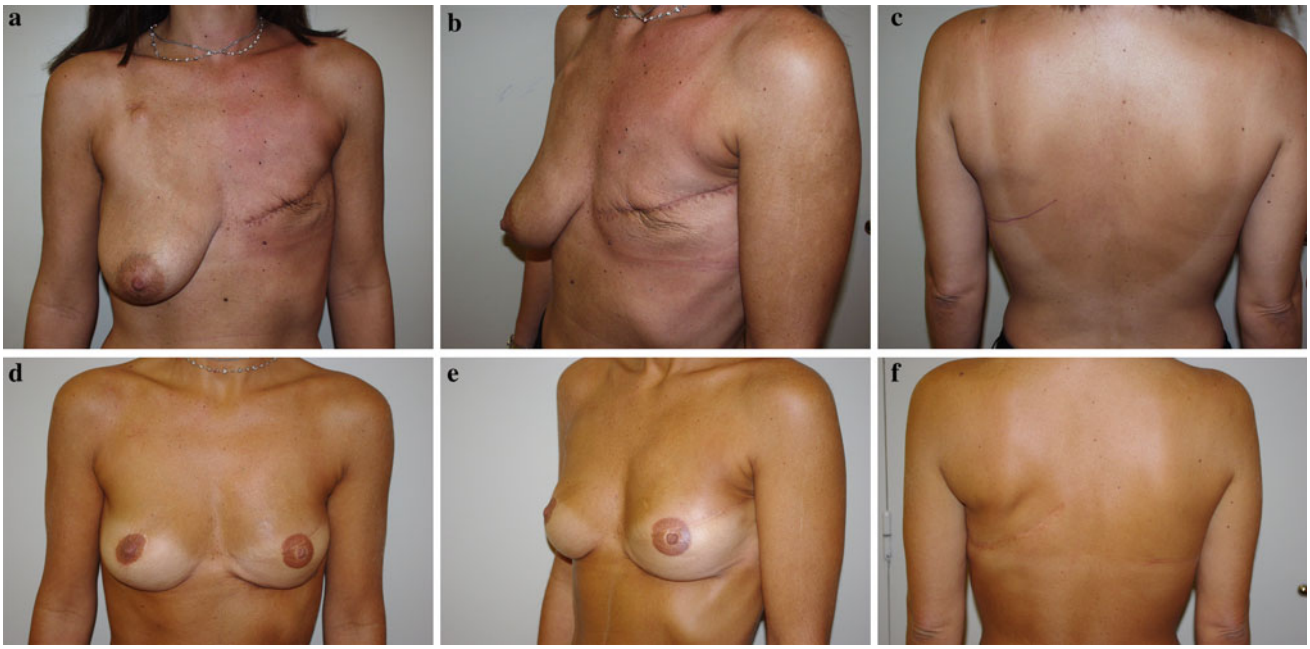

Fig. 27.3 Patient aged 45 years. Radiotherapy. Delayed left breast reconstruction in a slim patient: autologous latissimus dorsi reconstruction with an abdominal advancement flap. Right mastopexy and left lipomodeling (251 cm^3) at 5 months. Result 12 months after the last session. **a** Preoperative frontal view, **b** preoperative oblique view, **c** preoperative rear view, **d** postoperative frontal view, **e** postoperative oblique view, and **f** postoperative rear view

27.7 Complications

We describe the complications possibly associated with the procedure (1,000 surgical procedures done by the senior author), the strategies used to prevent their occurrence, and the techniques available for managing such complications when they occur.

27.7.1 Immediate Complications

- *Latissimus dorsi myocutaneous flap necrosis* one patient with complete flap necrosis (nonpatent vascular pedicle), and two patients with partial necrosis (maintenance of pure autologous reconstruction thanks to the lipomodeling procedure in the second stage). Early surgical reintervention was required on postoperative day 6 to remove the latissimus dorsi flap before onset of infection. Placement of a small abdominal advancement flap allowed subsequent breast reconstruction with subpectoral prosthesis implantation [1].
- *Postoperative dorsal hematoma* The risk of hematoma formation is related to the extent of the flap and is similar to that for patients undergoing classic latissimus dorsi flap harvest: less than 1 %. Careful ligation and cauterization of secondary segmental pedicles and compressive dressing of the wound are required to achieve good hemostatic control.
- *Infection* Owing to the autologous nature of the procedure and because the latissimus dorsi is highly vascularized, the risk of infection is extremely low (less than 1 %). Infection of the dorsal seroma is reported in approximately 1 % of cases. It is generally attributed to secondary superinfection in patients undergoing draining puncture.

27.7.2 Early Complications

- *Skin morbidity at the donor site* The extensive dorsal undermining required for elevating the pedicled myocutaneous latissimus dorsi flap can cause some compromise to the skin. The risk is relatively low (only 1 % in our patients). Skin necrosis happens when the flap harvested is too thick, with a dissection performed above the fascia superficialis [1]. Skin necrosis also occurs when an extensive dorsal paddle is harvested. We report no skin necrosis in our series.
- *Skin morbidity at the recipient site* In patients undergoing immediate breast reconstruction, the skin of the breast is preserved. Skin morbidity in these patients is thus not directly related to the technique used for reconstruction. In the case of delayed breast reconstruction with a thoracoabdominal advancement flap, marginal skin necrosis

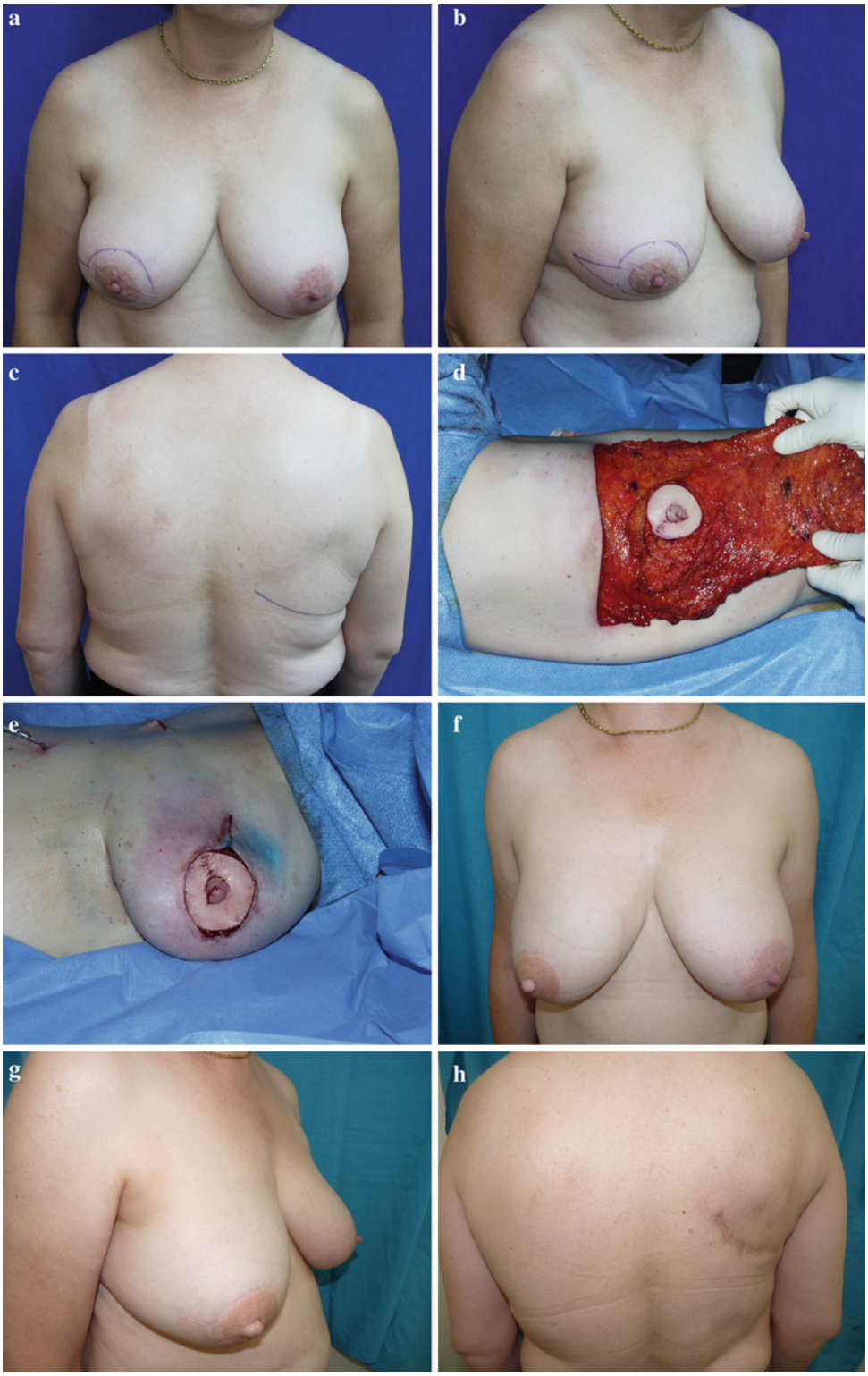

Fig. 27.4 Patient aged 43 years. Right immediate autologous latissimus dorsi breat reconstruction and immediate nipple reconstruction after skin-sparing mastectomy. Lipomodeling of the right breast (231 cm^3). Result 12 months after lipomodeling.
a Preoperative frontal view, **b** preoperative oblique view, **c** preoperative rear view, **d** perioperative latissimus dorsi flap, **e** perioperative nipple–areola complex reconstruction, **f** postoperative frontal view after latissimus dorsi reconstruction, **g** postoperative oblique view after latissimus dorsi reconstruction, and **h** postoperative rear view

is seen in approximately 5 % of patients. Marginal necrosis (0.5–1 cm) is amenable to excision and closure with the patient under local anesthesia, or secondary closure with insertion of a local flap.

- *Seroma formation at the donor site* This is the commonest and the mildest complication of the latissimus dorsi flap. In our experience seroma occurrence is more of a nuisance than a complication, and it has not

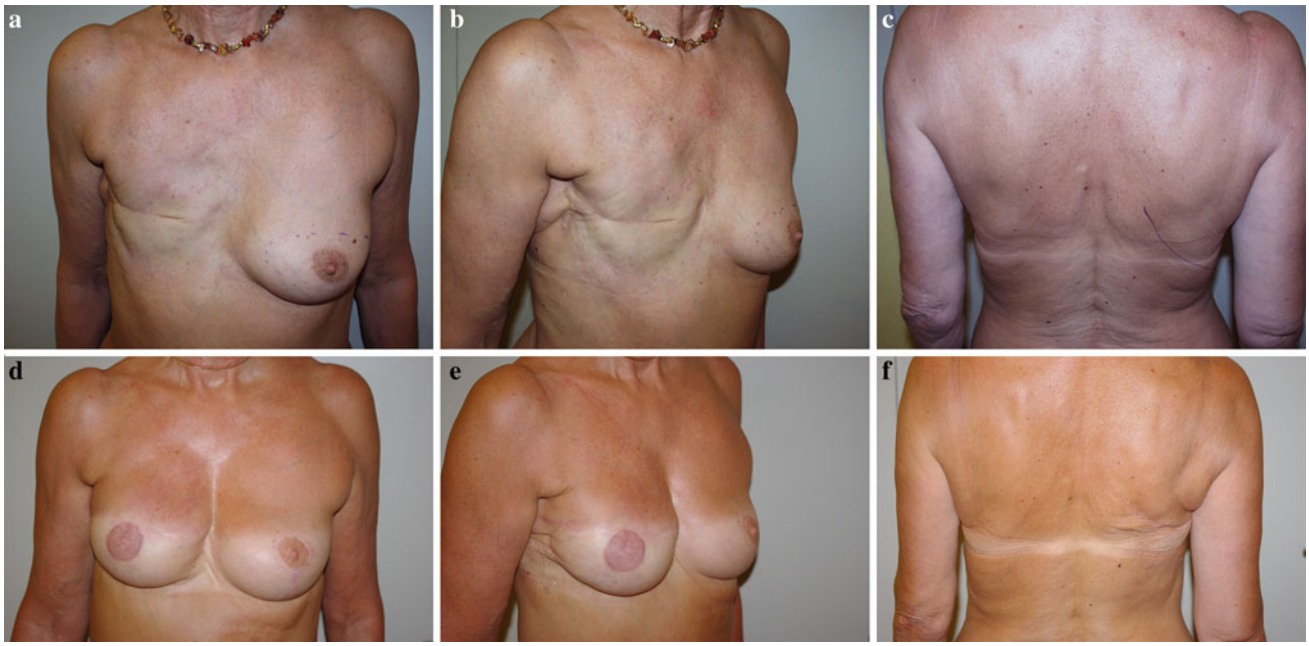

Fig. 27.5 Patient aged 48 years. Left immediate autologous latissimus dorsi breast reconstruction and immediate nipple reconstruction after skin-sparing mastectomy. Right autologous latissimus dorsi breast reconstruction, 6 months later. Lipomodeling of both reconstructed breasts (239 cm^3 *left breast*, 244 cm^3 *right breast*). Result 12 months after lipomodeling. **a** Preoperative frontal view, **b** preoperative oblique view, **c** preoperative rear view, **d** postoperative view after reconstruction, **e** postoperative oblique view after reconstruction, and **f** postoperative rear view after reconstruction

prevented the extensive development of the technique in our institution. Since early 2006, we have used quilting sutures systematically in our patients. The technique [8] consists in placing numerous stitches between the fascia superficialis and the thoracic wall (ten stitches on the upper cut dorsal flap, and nearly 16 stitches on the lower dorsal flap). Seroma incidence rates decreased from 21 to 9 % in our patient population.

- *Scapular sequelae* Latissimus dorsi muscle harvest may result in long-term deficit of shoulder function. However, the loss of the latissimus dorsi is well compensated by other muscles of the shoulder. In some rare cases (1 %), the patient may experience transient shoulder stiffness or even develop scapulohumeral periarthritis. This damage is more frequent after immediate postmastectomy breast reconstruction , when the constraints of reconstruction cumulate with those of mastectomy and axillary dissection, but it may also occur in patients undergoing mastectomy alone. Coping and psychological follow-up are very important to limit scapula and dorsal pains.

27.7.3 Late Complications

- *Loss or insufficient breast volume* There is usually a loss of breast volume in the 3 months following reconstruction [13]. Plastic surgeons involved in these procedures must have thorough knowledge of the outcome of fat grafting after autologous latissimus dorsi flap reconstruction. Lipomodeling [2, 13] should be offered to the patient after the autologous latissimus dorsi transfer. If the volume of the reconstructed breast decreases after a few months, it might be possible to improve the match with the natural breast by lipomodeling [14] with very good results in long-term follow-up. A transient overcorrection of the volume of the breast is necessary to obtain satisfactory results in the long term [15, 16]. When large breast augmentation is required, lipomodeling is repeated in several sessions [17, 18].
- *Dorsal pain* The intensity of pain may differ according to the patient's physical and psychological state, ranging from "no discomfort at all" to "intense pain." Pool physiotherapy is also a fundamental tool to achieve early and complete back and shoulder rehabilitation.
- *Dorsal hematoma* The late occurrence of a seroma–hematoma is reported in 2 % of our first 400 patients. Hematoma is caused by the collection of blood under the wound, at the donor site, possibly due to the rupture of a vein while making violent movements. Like dorsal seroma, this complication has decreased dramatically with the systematic use of quilting suture for the closure of dorsal wounds.

27.8 Conclusion

The autologous latissimus dorsi flap has become a procedure which is perfectly adapted to pure autologous breast reconstructions. After various technical improvements, its ease of use, versatility, reliability, acceptable constraints, and low complication rate make this technique our major surgical procedure for autologous breast reconstruction. Because of its excellent blood supply, the latissimus dorsi can be used in difficult reconstructions, in particular where there is marked radiation damage (recurrences after breast conservative treatment). A second stage with lipomodeling is indispensable to optimize the results by creating a reconstructed breast with volume, shape, and consistency close to those of a normal breast. We consider the autologous latissimus dorsi as an efficient recipient site for fat transfer (matrix for fat grafting).

This procedure needs a learning curve and specific training to produce best results. In our experience, this technique provides excellent long-term results in autologous breast reconstruction.

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