



Refinements of the LeJour vertical mammoplasty skin pattern for skin-sparing mastectomy and immediate breast reconstruction[☆]

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Mastopexy

Summary Background: Skin-sparing mastectomy (SSM) is a well-established technique for immediate breast reconstruction (IBR). When used for large and/or ptotic breasts, traditional SSM patterns produce long skin flaps prone to necrosis or 'T' junction breakdown. The authors have previously demonstrated the applicability of the LeJour-type vertical mammoplasty skin pattern to this group of patients. With further experience, indications for this procedure have been widened and the technique refined.

Results: Over five years, 26 immediate breast reconstructions were carried out in 19 patients using this technique: three expandable implants, seven LDs, three pedicled TRAMs, five free TRAMs, seven DIEPs and one SIEA flap. Fourteen patients (74%) had simultaneous contralateral balancing LeJour breast reductions or mastopexies. The remaining five patients had bilateral mastectomies and reconstructions using the vertical mammoplasty skin pattern for both breasts. All flaps were successful, but there were three cases of minor skin flap necrosis, three of delayed wound healing and two instances of significant post-operative bleeding. Cosmesis was suboptimal in the prosthetic reconstruction group, necessitating revisional surgery.

Discussion and conclusions: The vertical mammoplasty skin pattern was successfully used with a wide range of reconstructions. However, to avoid suboptimal

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cosmetic results and minimise wound healing problems this technique is not recommended in heavy smokers, very obese patients, those undergoing prosthetic reconstructions or neoadjuvant chemotherapy. The skin resection pattern should also be conservative. The LeJour-type vertical mammoplasty pattern is a viable alternative technique for SSM in selected patients, especially those requiring contralateral balancing surgery and undergoing autologous tissue reconstruction.

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Skin-sparing mastectomy¹ (SSM) and immediate breast reconstruction (IBR) are now widely accepted as oncologically safe.^{2–5} SSM aims to preserve as much native breast skin as possible and thus to optimize the cosmetic results of IBR. The common incisions for SSM are the various periareolar or racquet designs^{2,6–15} and the modified Wise pattern.^{1,3,6,16–19} These designs, however, present the ablative and reconstructive surgeons with problems in very large or significantly ptotic breasts. These include frequent delayed wound healing at the 'T' junctions and mastectomy skin flap necrosis with the Wise pattern^{1,3,6,17,18,20,21} while the long (and often thin) flaps produced by the circular and elliptical incisions account for the increased incidence of native skin flap necrosis.^{1,3,6,17,18,20,21} Access for axillary node dissection or microvascular reconstruction may also be a problem, while injudicious skin retraction may further compromise the vascularity of these long native skin flaps.^{3,9}

Preliminary results using the vertical mammoplasty skin pattern,^{22,23} as an alternative skin-sparing mastectomy design in six patients with large or ptotic breasts were recently reported by our group.²⁴ The rationale behind its use in these patients was that an inferior 'T' junction, the Achilles' heel of the Wise pattern, would be avoided, the scars minimized and excessively long skin flaps prevented, while at the same time providing adequate access for the mastectomy, axillary clearance and reconstruction. Clearly, in those patients requiring contralateral balancing surgery, greater symmetry could be achieved using the same vertical mammoplasty skin pattern on both the reconstructed and lifted/reduced sides.²⁴

After the initial positive experience, it was decided to extend the LeJour skin pattern beyond the original indications, to include moderately sized breasts with minimal ptosis, excessively large breasts with severe ptosis, obese patients and to expand the range of reconstructions. This paper presents the refinements of the technique derived from the five-year experience of a single reconstructive surgeon (CMM) with 26 applications of the

LeJour-type vertical mammoplasty skin pattern for SSM and IBR.

Technique, patients and methods

The operative technique used is based on that described in the preliminary report²⁴ with a few refinements. As previously stated the LeJour-type vertical mammoplasty skin pattern is marked out on the mastectomy side in collaboration with the ablative surgeon, taking into consideration the location and nature of the tumour. However, the new nipple position is now on both breasts located 1 cm lower than that predicted by the anterior projection of the inframammary fold. The medial and lateral boundaries of the vertical skin resection are determined by pushing the breast laterally and medially, respectively, to line up with the breast meridian,²³ but marked 1 cm closer to the nipple, thus making the vertical skin resection narrower (and the skin flaps longer), than that pertaining in a classical LeJour mammoplasty. This is important in reducing tension at the suture line. In contrast, when marking the contralateral breast, the vertical resection boundaries are not modified from the traditional LeJour pattern. A similar, but less conservative pattern is then marked out on the contralateral breast to allow a near symmetrical closure of the skin envelope on both sides. The mastectomy is then undertaken through the vertical skin elliptical incision. Access for the axillary clearance and, if indicated, dissection of the internal mammary vessels for free tissue transfer is obtained via the same incision. Then the reconstructive flap or prosthesis is placed into the mastectomy defect and the skin envelope closed in a LeJour–Lassus pattern. A contralateral LeJour-type breast reduction or mastopexy is then undertaken, with minimal flap undermining,^{25,26} and without a hitching suture to the pectoral fascia.²³ Nipple–areolar reconstruction is always deferred to a later date. Twenty-six immediate breast reconstructions were performed by a single surgeon (CMM) using this technique in 19 patients

undergoing SSM and simultaneous contralateral breast surgery.

Results

The LeJour vertical mammoplasty skin pattern for SSM was used in a wide range of immediate breast reconstructions (Tables 1 and 2) in 19 patients aged between 36 and 59 years (mean = 46.8 years). The mastectomy skin and breast resection margins were free of tumour and, after an average follow-up of 30.9 months (range = 4–69 months), none of the patients have developed locoregional recurrence. One patient, with a very large tumour needing chemotherapy to shrink it prior to surgery, has died of distant metastases. The case reports below illustrate the range of reconstructions for which the vertical mammoplasty skin pattern was used.

Significantly large breasts, DIEP flap (case 13)

A 50-year-old non-smoker with a left-sided breast cancer and almost grade 3 ptosis underwent immediate deep inferior epigastric perforator (DIEP) flap reconstruction and contralateral balancing LeJour reduction (Fig. 1). There were no healing problems.

Moderately sized breasts with minimal ptosis, LD flap and implant (case 8)

A 58-year-old lady with moderately sized breasts and minimal ptosis requested immediate breast reconstruction with a latissimus dorsi (LD) myocutaneous flap, aiming for the best possible symmetry achievable. A decision was therefore made to undertake a simultaneous contralateral LeJour mastopexy (Fig. 2).

Bilateral mastectomies and free TRAM flap reconstructions (case 17)

A 46-year-old patient had had a left lumpectomy and axillary clearance the previous year for multifocal invasive lobular carcinoma. Due to close resection margins, she received chemotherapy prior to the completion of mastectomy. During this neoadjuvant chemotherapy, she requested a right prophylactic mastectomy and bilateral immediate breast reconstructions. She opted for bilateral free transverse rectus abdominis myocutaneous (TRAM) flap reconstructions which, in view

of her ptosis (Fig. 3a, b and d), were carried out using the LeJour vertical mammoplasty skin resection pattern for skin-sparing mastectomy (Fig. 3c, e and f). The delayed wound healing on the side of the previous lumpectomy required dressings for three weeks. She went on to receive post-operative adjuvant radiotherapy for six weeks.

Prosthetic only reconstruction, salvage with LD flaps (case 3)

The 50-year-old patient, used to illustrate the operative technique in the 2003 paper, had developed bilateral capsular contractures, right implant malposition and persistent pain necessitating salvage with bilateral LD flaps. The cosmetic results are now acceptable (Fig. 4) and the patient is relatively symptom-free.

Small ptotic breasts, pedicled TRAM reconstruction (case 4)

This 40-year-old heavy smoker, with small, ptotic breasts underwent a left mastectomy, right mastopexy and a pedicled TRAM flap reconstruction. Post-operatively she developed partial necrosis of the lateral native skin flap which healed by secondary intention (Fig. 5). Please note that the nipples were also placed rather too high, a part of the technique which has since been modified.

The post-operative complications are summarised in Table 3. Minor skin flap necrosis occurred in three cases. One was in an obese patient with very thin skin flaps (case 11), one in a recipient of neoadjuvant chemotherapy (case 12), and one in a 41-year-old heavy smoker, who developed inferior skin flap necrosis (case 4). Three patients developed delayed wound healing requiring dressing changes for two to three weeks post-operatively. One followed a partial wound dehiscence in a very heavy smoker (case 10). In the second, the 'T' junction was intentionally left open after free flap re-exploration for venous congestion to accommodate post-operative swelling (case 2). The third was a patient who had a large lumpectomy scar prior to the mastectomy (case 17; Fig. 3).

The major problems experienced, however, were in the two prosthetic reconstruction patients. In the first, failure to inflate the expandable implant resulted in a poor cosmetic outcome necessitating revisional surgery to excise the multiple persistent skin folds (case 5). The second patient (case 3) developed painful capsular contractures of her expander reconstructions accompanied by unilateral malpositioning of the right

Table 1 Clinical summary of patients undergoing LeJour vertical mammoplasty skin pattern for skin-sparing mastectomy and immediate breast reconstruction

Case	Age	Smoker	ChemoTx	RT	Indication	Reconstruction type	Contralateral surgery	Complications/ notes	F/U (m)	Mastectomy weight (g)	Contralateral weight
1	36	NS	N	N	T1N0 grade II IDC (ER+)	LD + style 150 expander	Reduction	N	43	731	369 g
2	56	NS	Y – post-op	Y – post-op	T3N1 IDC (ER+)	Free TRAM	Mastopexy	Re-explored for venous thrombosis	69	730	25 g
3	46	NS	N	N	Prophylactic BRCA1	Style 150 expanders bilaterally	N/A	LD revisions five years later for severe cc and implant malposition	69	R – 449; L – 450	N/A
4	40	S	N	Y – pre-op	T2N0 grade I ILC	Pedicled TRAM (surgically delayed)	Mastopexy	Nipples too high, minor skin flap necrosis	57	360	Skin only
5	54	NS	N	N	High grade DCIS	Style 150 expander	Mastopexy	Pre-op wrinkling and failure to expand	68	611	151 g
6	33	S	Y – neoadjuvant	Y – pre-op	T4N1 IDC	Pedicled TRAM (surgically delayed)	Mastopexy	N	15	576	35.5 g
7	54	NS	N	N	T1N0 IDC	Pedicled TRAM	Augmentation mastopexy	N	69	413	Skin only
8	58	NS	N	N	DCIS	LD + implant	Mastopexy	N	27	359	Not recorded
9	55	NS	Y – post-op	Y – post-op	T2N+ (2/19) grade III ILC (ER/PR+)	Free TRAM	Reduction	Synmastia – not enough skin to close	27	1629	297 g
10	41	S	Y – post-op	Y – post-op	T3N+ (9/21) grade II IDC (ER+)	Free muscle-sparing TRAM	Reduction	Healing problems	27	673	42 g – recorded
11	46	NS	Y – neoadjuvant	Y – pre-op	T1N+ (7/24) grade 1 IDC	Autologous LD	Reduction	Increased BMI, SSM flap necrosis	18	954	71 g – recorded
12	39	NS	Y – neoadjuvant	Y – pre-op	T2N+ (1/20) grade II ILC (ER/PR+)	DIEP	Reduction	Minor skin flap necrosis	21	758	291 g
13	50	NS		Y – pre-op	T2N1 IDC	DIEP	Reduction	N	31	859	60 g – recorded
14	51	NS	N	N	DCIS + grade II invasive foci after WLE	LD + implant	Reduction	N	14	1002	554 g
15	44	NS	Y – neoadjuvant	Y – pre-op	Previous WLE, BRCA2 gene; benign	DIEP L + SIEA R	N/A	Returned to theatre for bleeding	5	R = 745; L = 570	

	16	59	S	Y – post-op	Y – post-op	Y – pre-op	T4N+ (6/14) ILC (ER+)	Autologous LD	Reduction	N	10	967	258 g
17	46	NS	Y – post-op	Y – pre-op	L = T2N+ (2/12) ILC, R = benign		Bilateral free TRAMs	N/A		Minor wound healing problems	9	L = 692; R = 873	
18	36	S	N/A	N/A		Prophylactic; benign	Bilateral DIEPs	N/A			5	L = 955; R = 1300	
19	50	NS	N	Y – pre-op	R = T3N2M1 grade II IDC, L = T3N + M1 ILC + LCIS (ER+)		Bilateral DIEPs	N/A		R: Haematoma – no flap compromise	4	L = 602; R = 525	

S = smoker, NS = non-smoker, N/A = not applicable, Y = yes, N = no, DCIS = ductal carcinoma in situ, ILC = invasive lobular carcinoma, IDC = invasive ductal carcinoma, ER+ = oestrogen receptor positive, PR+ = progesterone receptor positive, WLE = wide local excision, TRAM = transverse rectus abdominis myocutaneous flap, DIEP = deep inferior epigastric perforator flap, SIEA = superficial inferior epigastric artery flap, LD = latissimus dorsi flap, L = left, R = right, cc = capsular contracture, pre-op = pre-operatively, and post-op = post-operatively.

Table 2 Reconstructive methods used after SSM

Method	No. of reconstructions
Prosthetic only (McGhan style 150 expander ^a)	3
Latissimus dorsi myocutaneous flaps	7 (2 totally autologous)
Pedicled TRAM flaps	3 (2 surgically delayed)
Free muscle-sparing TRAM flaps	5
DIEP flaps	7
SIEA flap	1

^a Inamed corp., County Wicklow, Ireland

expandable implant. This culminated in salvage with LD myocutaneous flaps and anatomical cohesive gel implants (Fig. 4).

Discussion

Indications (Table 4)

The vertical mammoplasty skin pattern was initially used in the immediate autogenous tissue reconstruction of patients with large and/or ptotic breasts (Table 4).²⁴ It proved to be especially useful in those who required simultaneous contralateral balancing mastopexies or reductions. Although at first the technique was deemed less suitable for patients with moderately sized/non-ptotic breasts, it was extended to this group of patients with the specific aim of improving symmetry to good effect (Fig. 2). It was also successfully applied to patients undergoing LD flap reconstruction who often have moderately sized breasts. With these encouraging results, it was decided to also use this technique in obese patients, such as those suitable for totally autologous LD reconstructions. Finally it was utilised in all patients requesting the best possible symmetry from immediate reconstruction and contralateral balancing surgery, regardless of the degree of ptosis and whether or not they were obese, smokers or recipients of neoadjuvant chemotherapy. Consequently the present report is one of the larger published series on breast reduction patterns for mastectomy and immediate reconstruction.^{12,16,18,19}

The vertical mammoplasty pattern is especially suitable for those requiring a balancing contralateral breast reduction or mastopexy because it allows adequate control of the post-mastectomy skin envelope thus optimising the cosmetic results. Additionally the application of the vertical skin resection pattern to both breasts improves

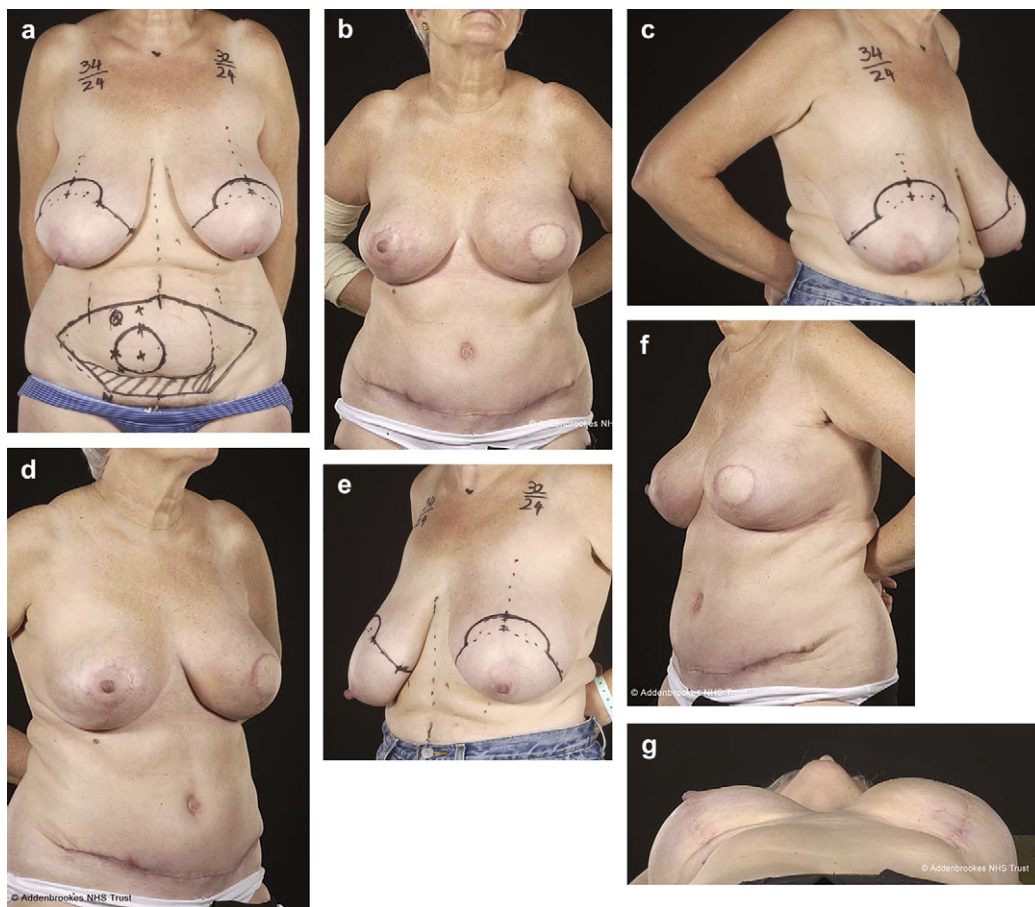


Figure 1 This 50-year-old patient with very large breasts and almost grade 3 ptosis (a, c and e) had excellent cosmetic results following a DIEP flap reconstruction and contralateral reduction (b, d, f and g).

symmetry. It gave excellent access for the mastectomy, axillary dissection and immediate reconstruction and in almost all cases without the need for extra incisions of the breast or axillary region.

The LeJour-type pattern was also applied to bilateral immediate reconstructions. In our experience these cases are particularly suitable for this skin-sparing pattern, because symmetry is easier to achieve and excellent cosmetic results can be obtained.^{18,27} Interestingly, the most recent cases, which have been bilateral reconstructions, have had problems with significant bleeding and haematoma formation, necessitating a return to theatre. No flap loss has been incurred, however. The occurrence of significant bleeding in bilateral cases is most probably unrelated to the use of the vertical mammoplasty pattern.

Patients with significantly ptotic or large breasts are not ideal candidates for prosthetic reconstruction or traditional SSM incisions as described earlier.²⁴ Therefore a technique which reduces the length of skin flaps whilst at the same time 'mimicking' SSM (preserving the skin envelope

and limiting the extent of scarring) is to be preferred, as documented by others.^{15,18,19} Reduction of the skin envelope is almost always needed in patients with large, ptotic breasts especially if they request simultaneous contralateral balancing surgery.^{6,16,28}

Because of the significant problems encountered in the prosthetic group, it is strongly recommended that this technique should not be used in implant-only reconstructions. In such cases it is preferable to use breast reduction patterns which incorporate a de-epithelialised upper or lower¹⁸ breast flap to buttress or 'waterproof' or strengthen the prosthetic pocket, or indeed an LD muscle harvested through the mastectomy incision in place of the de-epithelialised inferior skin flap.²⁹

Caution is also now urged in 'high risk' patients such as the heavy smokers, the obese and those receiving neoadjuvant chemotherapy, because of the higher incidence of skin flap necrosis and delayed wound healing. While delayed wound healing is a nuisance for the patient, due to

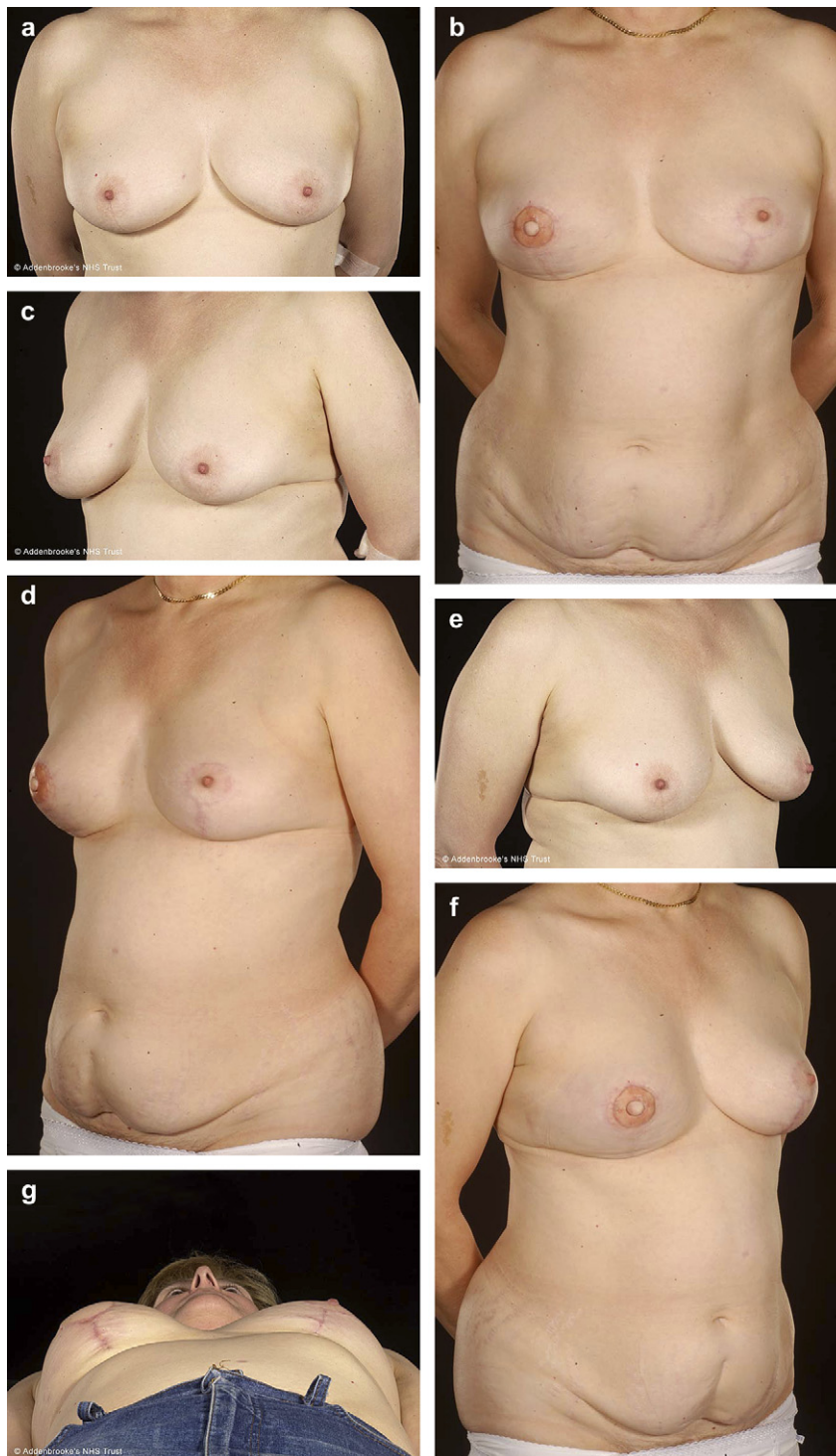


Figure 2 An application of the LeJour technique to combined LD and implant reconstruction with contralateral mastopexy. Pre-operative appearances (a, c and e). Post-operative appearances before (g) and after (b, d and f) right nipple–areolar reconstruction.

frequent dressing changes, it was not a major problem in autologous tissue reconstructions,^{17,21} as it did not require revisional surgery or readmission to hospital. However, it can delay the start of the post-operative adjuvant chemo or

radiotherapy and therefore could potentially disadvantage the patient oncologically. This has to be an important consideration in selecting this technique and the patient must be counselled accordingly. Additionally, in immediate prosthetic

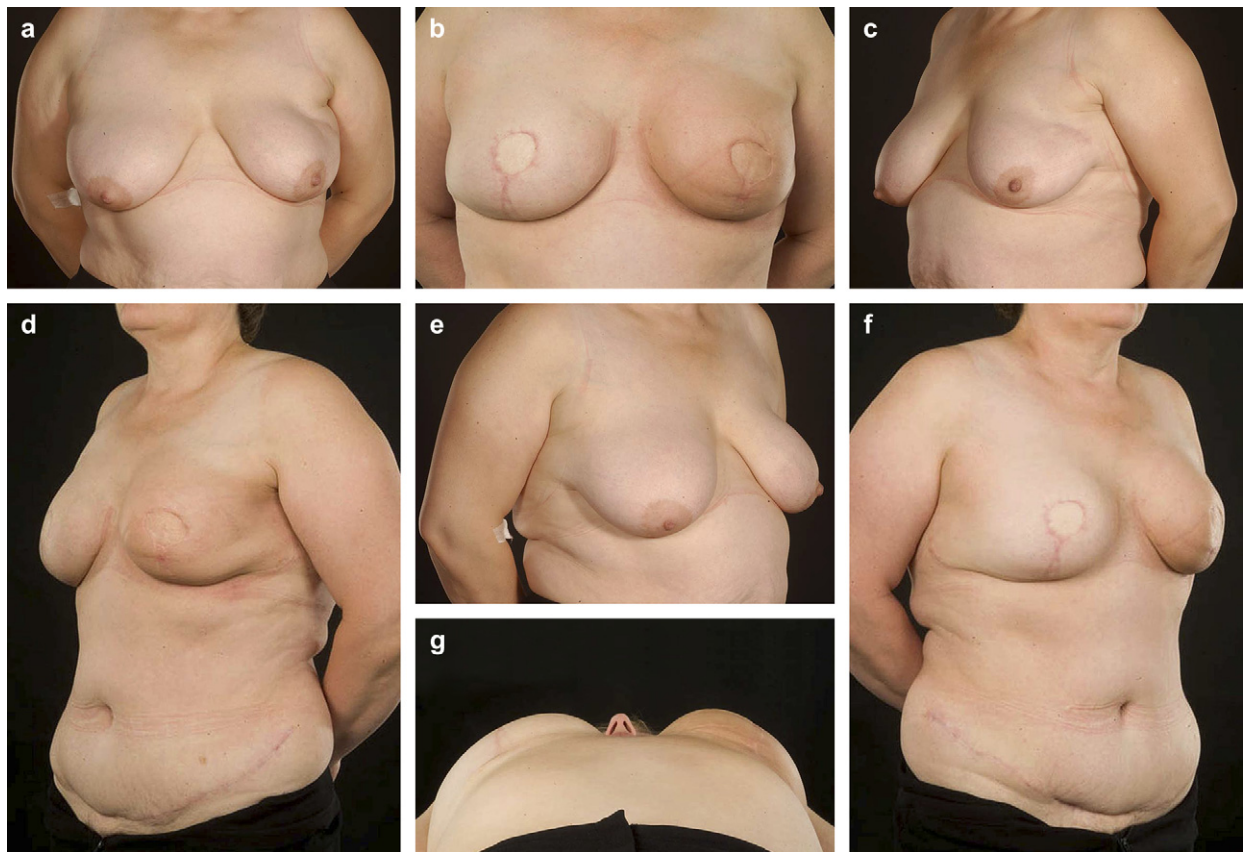


Figure 3 This 46-year-old patient with large almost grade 3 ptotic breasts had a left lumpectomy and radiotherapy (a, c and e) prior to bilateral mastectomies and bilateral free muscle-sparing TRAM flaps. There was delayed healing on part of the left vertical suture line. Note the smoothing of the puckered vertical scars with time (b, d, f and g).

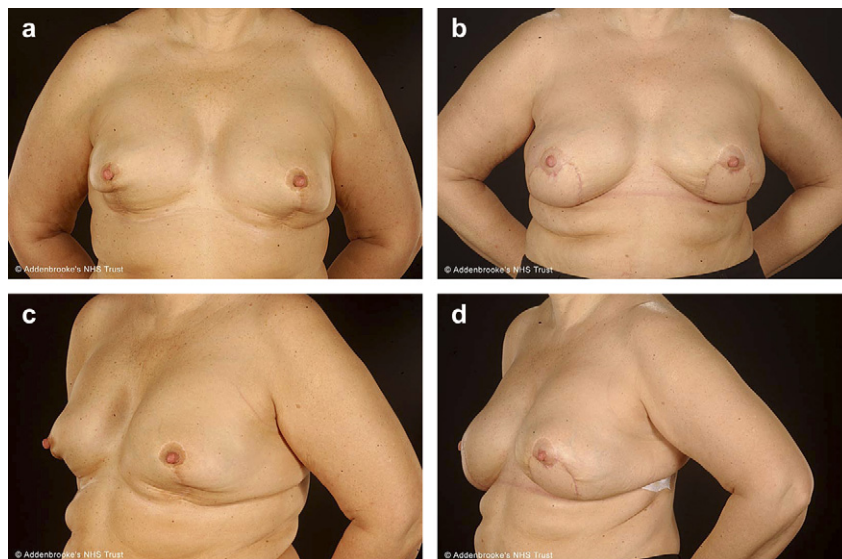


Figure 4 Salvage of prosthetic only reconstruction with LD flaps. Prosthetic only reconstruction complicated by capsular contracture, implant malposition, and persistent pain (a and c). The tightness was only relieved by the LD flaps (b and d).

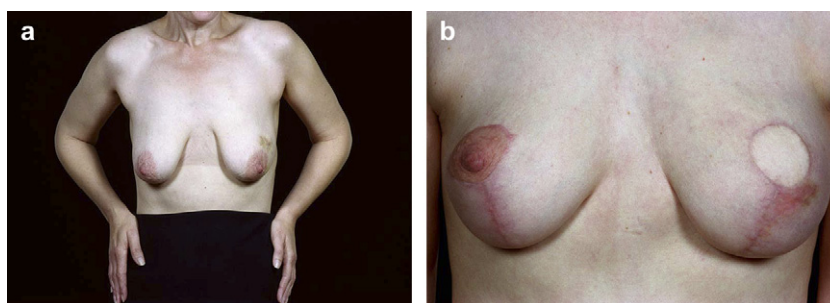


Figure 5 Reconstruction of small, but ptotic breasts (a) with a pedicled TRAM flap in a heavy smoker. Note the necrosis of the native skin flap which healed with dressings only. (b) The nipple–areolae are too high on the breast mounds and too wide.

reconstructions, necrosis of skin flaps, and its attendant delayed healing, can result in implant exposure, infection, extrusion, or explantation as reported with similar techniques.¹⁸

Complications (Table 3)

Using the vertical reduction mammoplasty skin pattern results in relatively shorter skin flaps than in established SSM techniques, apart from the Wise pattern.^{1,3,6,17,19} Additionally, they have broader bases than those in the Wise pattern skin-sparing mastectomies. The incidence of skin flap necrosis should therefore be lower than the 25% reported by Skoll and Hudson.¹⁹ In this present series of 26 reconstructions, three minor cases of mastectomy skin flap necrosis were encountered, and this seems to be a universal problem in SSM regardless of type because of the thinness and angulations of the mastectomy flaps.^{6,9,14,17,18,28} These patients, however, all had other risk factors for skin flap necrosis, so with more careful patient selection this may have been largely avoided. The LeJour skin pattern allowed the formation of two broad-based flaps, a factor which is said to increase the resilience of the skin flaps.^{6,18,19} Another important factor in the viability of the skin flaps is their thickness as shown by the occurrences of

Table 3 Surgical outcomes

Complication	No. of patients
Native skin flap necrosis (minor)	3
Delayed wound healing	3
Bleeding	
Return to theatre	1
Haematoma – no flap compromise	1
Implant-related complications	
Failure to expand	1
Salvage with LD	1

delayed wound healing in the patient (case 11) in whom the flaps needed to be made very thin on oncological grounds. Even with the modification of conservative skin resection, described in the 'Technique, patients and methods' section, it is often difficult to avoid some tension at closure. This problem is not only unique to the LeJour pattern but also occurs in the Wise pattern.^{6,18}

The filling of the breast envelope with autologous tissue instead of prostheses may reduce the risk of necrosis,^{12,17} and this may account for our lower incidence of the problem. It certainly allows healing to occur without endangering the reconstruction as it is made up of vascularised tissue. The major complications necessitating salvage or revisional surgery were in the implant-only reconstructions. For this reason the technique is to be eschewed in this group.

Refinements (Table 4)

The vertical mammoplasty technique for SSM and IBR has evolved with further experience. The vertical skin resection margin should be conservative, as illustrated by a 54-year-old patient with

Table 4 Modifications to technique

Patient selection – caution in
Heavy smokers
Very obese patients
Neoadjuvant chemotherapy
Synmastia
Technical details
• Learning curve for both ablative and reconstructive teams
• Avoid in prosthetic only reconstruction
• Conservative vertical skin resection (except if otherwise dictated oncologically)
• Flexibility in design to accommodate tumour
• Position nipples slightly lower than predicted from reduction mammoplasty

synmastia who had a large, superficial tumour in the inferior part of the left breast (case 9; Fig. 6). On oncological grounds the vertical resection margin had to be wider than usual and extended almost to the inframammary fold (Fig. 6a and b). Following the right mastopexy, it was impossible to close the vertical component of the left LeJour SSM pattern directly and therefore an elongated TRAM flap skin paddle had to be preserved (Fig. 6c). Conservative vertical skin resection should also reduce the incidence of skin flap necrosis as it reduces the degree of tension on closure, one of the factors accounting for its high incidence in the Wise pattern SSM.^{6,3,17}

It was also observed that the nipples have to be positioned at least 1 cm lower than predicted by standard breast reduction techniques, to avoid up-turned nipple–areolar complexes, which occur with post-operative ‘bottoming out’, an unavoidable occurrence when the LeJour pillars are not approximated and the flap or breast reduction pedicle is not hitched to the pectoralis muscle. This is well illustrated by one of our early cases in whom the new nipple positions were too high, and the right nipple–areolar complex had been made too wide in the attempt to match the contralateral skin paddle (case 4, Fig. 5).

Flexibility must be shown in the design of the vertical mammoplasty skin pattern to allow for adequate tumour resection. The pattern may therefore be positioned lower or higher than in the standard breast reduction as dictated by oncological considerations. Where a superficial

tumour is located away from the breast meridian the technique should not be used,²⁴ and if the same objective is to be achieved, a Wise pattern keyhole reduction pattern^{1,17,18} should be employed instead. In common with the Wise pattern and B-mammoplasty skin-sparing mastectomy techniques the vertical skin pattern avoids scarring in the upper pole of the breast,^{15,16,28} thus contributing to improved cosmesis.

The LeJour-type vertical mammoplasty skin pattern can be successfully applied to a variety of reconstructive techniques following SSM, although it is not a panacea for every mastectomy patient. In the suitable patient it offers the ablative surgeon more than adequate access for the mastectomy and axillary clearance and the reconstructive surgeon wide exposure for the reconstruction. Additional scars for the axillary dissection are also avoided. The technique was most useful for patients with large and/or ptotic breasts undergoing immediate autogenous tissue reconstruction, including free and pedicled TRAMs, DIEP flaps, SIEA flaps and LDs. The pattern is especially suitable for those requiring contralateral balancing breast surgery. It can also be used in patients requesting the best possible cosmesis/symmetry regardless of the grade of ptosis.

Careful patient selection is advised especially in smokers, those with high BMIs and neoadjuvant chemotherapy patients. The skin resection must be conservative compared to the normal vertical mammoplasty. This should, however, not compromise the oncological resection. The LeJour vertical

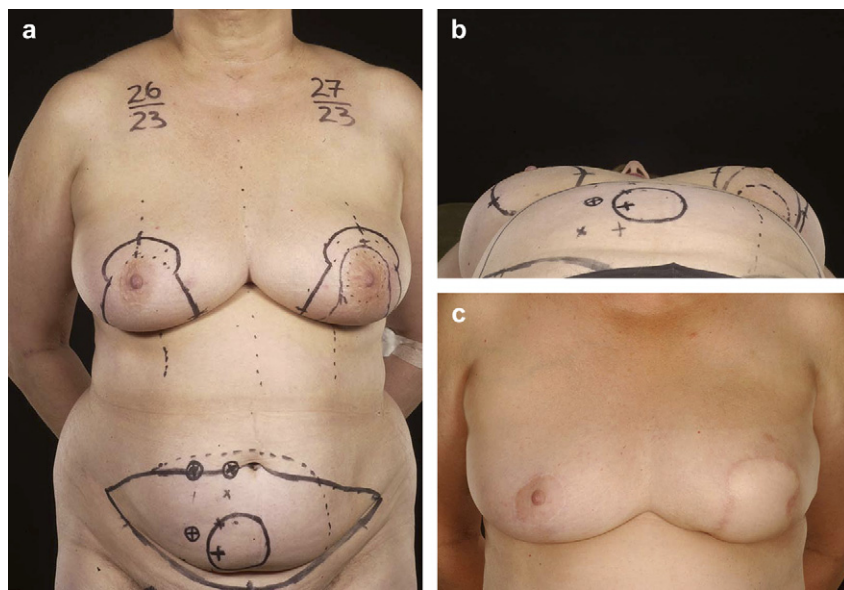


Figure 6 A patient with synmastia and a left breast tumour involving the inferior skin (a and b). Appearances following immediate muscle-sparing free TRAM flap showing the vertical skin paddle necessitated by tumour resection (c).

mammoplasty skin pattern improves symmetry without unduly increasing the wound morbidity beyond that seen with other SSM incisions.

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