World J Surg
DOI 10.1007/s00268-017-4041-4

ORIGINAL SCIENTIFIC REPORT

Treatment of Implant Exposure due to Skin Necroses after Skin Sparing Mastectomy: Initial Experiences Using a Not Selective Random Epigastric Flap

Estíbaliz Echazarreta-Gallego[1] · Guillermo Pola-Bandrés[1] · María Dolores Arribas-Del Amo[1] · Ismael Gil-Romea[1] · Ramón Sousa-Domínguez[1] · Antonio Güemes-Sánchez[1]

Abstract Breast prostheses exposure is probably the most devastating complication after a skin sparing mastectomy (SSM) and implant-based, one-stage, breast reconstruction. This complication may occur in the immediate post-operative period or in the weeks and even months after the procedure. In most cases, the cause is poor skin coverage of the implant due to skin necrosis.

Patients and methods Eight consecutive cases of implant exposure (or risk of exposure) due to skin necrosis in SSM patients over a period of 5 years, all patients were treated using a random epigastric rotation flap, executed by the same medical team.

Results A random epigastric flap (island or conventional rotation flap) was used to cover the skin defect. All the patients completed the procedure and all prostheses were saved; there were no cases of flap necrosis or infection.

Conclusions Cases of skin necrosis after SSM and immediate implant reconstruction, in which the implant is at risk of exposure, can be successfully treated with a random epigastric rotation flap.

Introduction

In recent years, the use of skin sparing mastectomy (SSM) and nipple sparing mastectomy (NSM) with immediate reconstruction has increased due to risk reduction procedures and the treatment of breast cancer [1]. After these interventions, direct-to-implant prosthetic breast reconstruction is an attractive solution for volume replacement [2]. The operation removes the gland preserving the skin and the nipple-areola complex (NAC) or replaces the vascularised NAC for a free nipple graft. Oncologic validity of the procedure has been demonstrated [3]. It is believed that the risk of developing breast cancer is lessened when more tissue is resected; it is therefore argued that large quantities of breast parenchyma should be removed and fine skin flaps should be obtained, leaving the NAC as thin as possible. This helps avoid relapse but increases the risk of skin and NAC viability [4].

A significant number of these procedures are performed following vertical or conventional Wise-pattern skin incisions. Breast implants are usually enclosed by the pectoralis major muscle (completely or partially) [5], the biological mesh [6] or simple skin coverage [7]. These surgeries are not exempt from complications; prostheses exposure is one of the most important (incidence ranges from 0.25 to 8.3%) [8]. The condition can have very different clinical presentations (ischemic skin, poor skin coverage, necrotic scar, chronic or partial fistulae and even complete implant exposure) and can be considered as a devastating complication; in many cases, if not treated, infection occurs and implant removal becomes a necessity. Many of the prostheses exposure cases are induced by skin necrosis caused by excessive subcutaneous fat tissue removal or wound dehiscence that results from excessive tension in the suture line.

✉ Estíbaliz Echazarreta-Gallego
esti.egallego@hotmail.com

[1] Breast Unit. Department of Surgery, Hospital Clínico Universitario de Zaragoza, Avenida San Juan Bosco 15, 50005 Saragossa, Spain

Published online: 02 May 2017

When infection occurs, most patients should be treated with the conventional two-stage approach (removal of the prostheses, antibiotics and secondary reconstruction using tissue expanders).

Although skin necrosis usually appears in the period immediately after the SSM intervention, implant exposure can occur in the weeks or months following the operation, when conservative actions are used to treat the necrotic scar. Conservative treatment of prostheses infection with intact skin (IV antibiotics, drain placement) is often effective [9]. Nevertheless, in cases of persistent infection, traditional treatment (implant removal and secondary reconstruction in the following months) becomes necessary [10]. When coverage of the implant is compromised (lack of well-irrigated skin), a surgical intervention is usually required. If the skin becomes necrotic, there is a risk of prostheses exposure (if there is no viable tissue interposed between the implant and the skin such as muscle) and on diagnosis, if coverage of the implant is impossible, the result will be the loss of the implant and the complete failure of the surgical procedure.

Biological or polyglycolic acid mesh interposition between the skin and the implants does not guarantee a successful outcome in cases of skin necrosis. Exposed mesh (irrespective of composition) can provoke infection and the loss of the implant [11].

Treatment of skin necrosis with risk of prostheses exposure ranges from conservative wound management (scar debridement, local and parenteral antibiotics, primary closure of the defect) to muscle or skin flap interposition and prostheses replacement. There are no clear indications for a specific technique for saving implants; a number of procedures have been employed: skin and muscle flap interposition; capsule interposition; pedicle and free skin flaps [12].

The random, rotational midline pedicle epigastric flap is a suitable, relatively simple operation for achieving implant coverage and resolving defects and pathological tissue scars [13].

Aim of this paper

This work examines the use of the random epigastric rotation flap in the treatment of a consecutive case series of patients suffering skin necrosis that has caused implant exposure or a high risk of the condition.

Patients and methods

A review of our database identified all cases of implant exposure caused by skin necrosis after skin sparing mastectomy in the last 5 years.

All the implants were textured silicone, and coverage was muscle or skin. Data on the patients, the procedures and the results are shown in Table 1. All the patients were administered perioperative antibiotics in line with the hospital protocol (single doses of amoxicillin–clavulanic, 1 h before the procedure and for 3 days if large portions of deepithelized skin were laid down). Single-stage, direct-to-implant, breast reconstructions using definitive silicone implants, avoiding tissue expanders, was used in all the cases.

Patients that suffered prostheses infection (fever, skin swelling, pain or suppuration), with or without skin necrosis, were excluded from the series.

Surgical technique (SSM)

Depending on breast size and BMI, one or two techniques involving vertical scar patterns were used for the SSM:

1. The dermal sling procedure [14] was employed for large breasts with ptotic degree II or more (NAC position below the submammary crease or sternal notch to superior part of the NAC distance of more than 22 cm). The technique has been previously described [15], but we have introduced a number of modifications:
   A skin mark is drawn in the erected position (an inverted V), locating the tip of the V at 21 cm from the sternal notch (along the breast meridian). An inferior pedicle (from the submammary crease) deepithelized skin flap is obtained. After breast removal (leaving thin skin flaps), the inferior insertions of the pectoralis major muscle are detached and a pocket is created by suturing the muscle to the deepithelized skin flap that houses the breast implant. The pocket is later covered by the skin flaps. A temporary closing of the pattern allows us to select the best site for the new NAC position (4.5–5 cm from the submammary crease), the site is deepithelized, and the (previously thinned) NAC is grafted as a free nipple graft.
2. A pure subcutaneous mastectomy, sparing large portions of skin and the NAC through a narrow Wise-pattern (horizontal with very short incisions). Prostheses placement is under the pectoralis major muscle in the inner part and pure skin coverage on the outer. The vertical skin suture line is protected by overlapping the short deepithelized portion of skin of the Wise-pattern vertical incision.

Surgical technique (epigastric flap) (Figs. 1 and 2)

With the patient under general anaesthesia, the flap is drawn on the skin. The base of the flap is close to the middle line, parallel to the infra-mammary fold, at sufficient distance to be able to rotate and reach the skin defect.

Table 1 Patients included on the study

Patient	Age	BMI kg/m^2	Radiated	Implant status	Smoking	Primary indication	Skin defect		Previous Surgery		Pathology	Time from surgery to skin dehiscence	Outcome
							Size	Location	Technique	Implant coverage			
# 1	46	20,27	No	Exposed	Yes	Fibrocyst disease	<2 cm^2	Inner	Subcutaneous	Skin	Fibrocyst disease	1 year	OK
# 2	54	21,45	No	Exposed	Ex smoker	High risk (BRCA)	>2 cm^2	Central	Dermal sling	Muscle/skin	Normal	6 months	OK
# 3	45	21,60	No	Exposed	Yes	High risk (familiar)	<2 cm^2	Central	Subcutaneous	Skin	Fibrocyst disease	1 month	OK[a]
# 4	51	24,82	No	Risk	Yes	Infiltrating carcinoma	>2 cm^2	Inner	MRM	Muscle (Latissimus)	IDC T4N3M0	2 months	OK
# 5	65	25,34	No	Exposed	Yes	Infiltrating carcinoma	<2 cm^2	Areola	Dermal sling	Muscle/skin	IDC T2N0M0	2 months	OK
# 6	42	18,83	Yes	Exposed	Ex smoker	Infiltrating carcinoma	<2 cm^2	Central	Dermal sling	Muscle/skin	IDC T1aN0M0	3 weeks	OK[b]
# 7	52	24,44	No	Exposed	No	Intraductal carcinoma	<2 cm^2	Central	Dermal sling	Muscle/skin	DCIS	1 month	OK
# 8	63	23,25	Yes	Risk	Yes	Infiltrating carcinoma	>2 cm^2	Outer	Dermal sling	Muscle/skin	IDC and LCIS	9 years	OK

MRM Modified radical mastectomy, *LCIS* Lobular carcinoma in situ, *IDC* Infiltrating ductal carcinoma, *DCIS* Ductal carcinoma in situ

[a] Reintervention due to skin dehiscence

[b] Cellulitis that promoted antibiotics

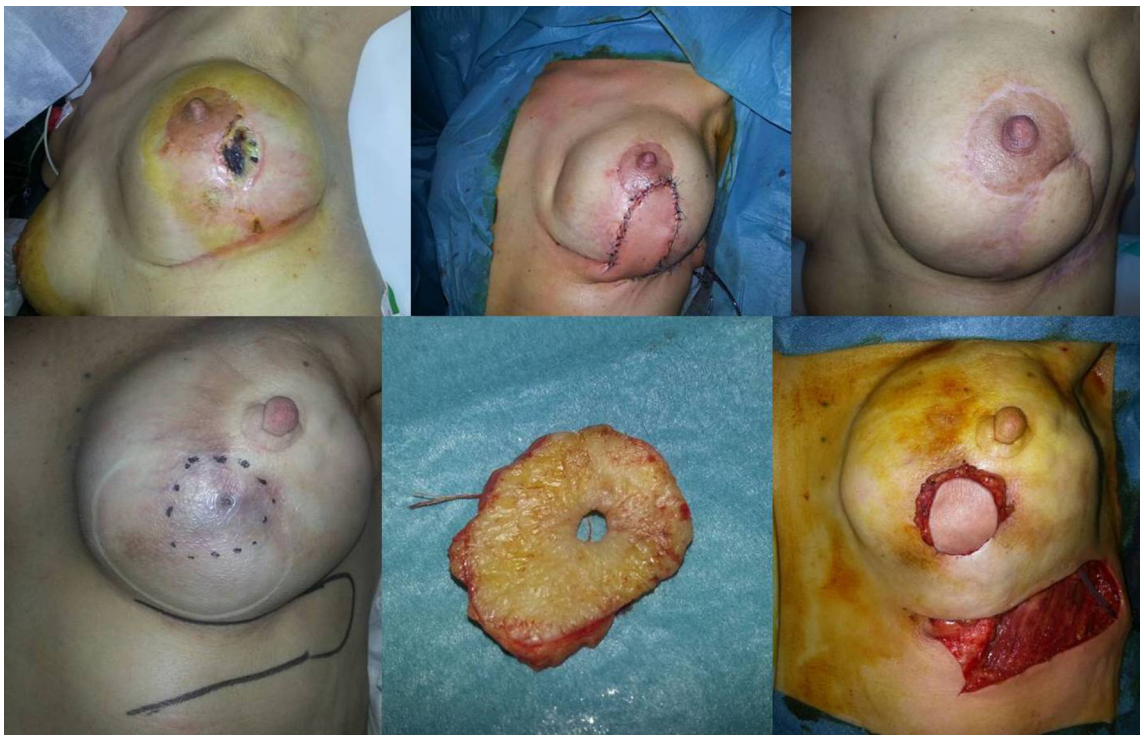

Fig. 1 Upper line of figures: Case 6. Skin necroses of the vertical scar after a SSM at 3-week post-operation implant exposure (*left*), result at 2 weeks after epigastric flap closure (*centre*) and result at 6 months (*right*). Lower line of figures: Case 3. Cutaneous ulcer in the lower portion of the breast and flap design (*left*), resected skin with impaired irrigation, including the resected ulcer (*centre*) and island flap raised to cover the defect (*right*)

On some occasions, the tip of the flap can extend to the anterior axillary line. The width of the flap should allow the skin of the donor site to be closed without tension (up to 8 cm).

All scars and compromised tissue must be eliminated from the cutaneous defect with the aim of ensuring well-irrigated skin edges. At this point, the periprosthetic capsule, if present, is opened and the implant is temporally removed, cleaned and kept in betadine solution.

The flap blood supply is obtained from branches of the superior epigastric vessels, there is no need to dissect or isolate the vessels, and a random distribution of the vessels is enough to guarantee irrigation. The flap dissection includes skin, subcutaneous tissue and muscle fascia.

After lifting the flap, a complete 360° capsulotomy is carried out. Once the dissection is complete, the flap is easily rotated to cover the skin defect and sutured to its edge. The implant is placed in its original pocket (suction drains are a requisite). The secondary defect, donor site, is sutured—a simple closure using monofilament.

Post-operative care includes monitoring for local infection or flap necrosis. Antibiotic treatment is extended for three days and discontinued if there are no signs of infection or skin necrosis.

Results

From the series of 324 patients that underwent a skin sparing mastectomy, 125 were purely prophylactic (all were bilateral procedures) and 149 patients were treated for breast cancer (120 bilateral and 29 unilateral). There were 8 cases of skin necrosis (most problems were in the vertical arm of the wise-pattern) with incipient implant exposure or massive prostheses exposure. These patients were treated by means of the random epigastric flap. Data on the patients and procedure are given in Table 1.

All the patients were treated using the same technique (pure or island epigastric flap) and operated on by the same surgeon. In cases 1 and 2, the flap was subcutaneously tunnelled (the tunnelled area was partially de-epithelised as an island flap). The mean surgical time was 40 min (between 35 and 75 min). Blood loss was negligible. Implant sizes ranged from 310 to 450 cc.

No infecting organisms were identified in the culture of the periprosthetic liquids.

The operations were successful, and the implants were saved in all cases, even with patients that had undergone radiation therapy. There were no major complications, but one patient was re-operated due to skin dehiscence (a

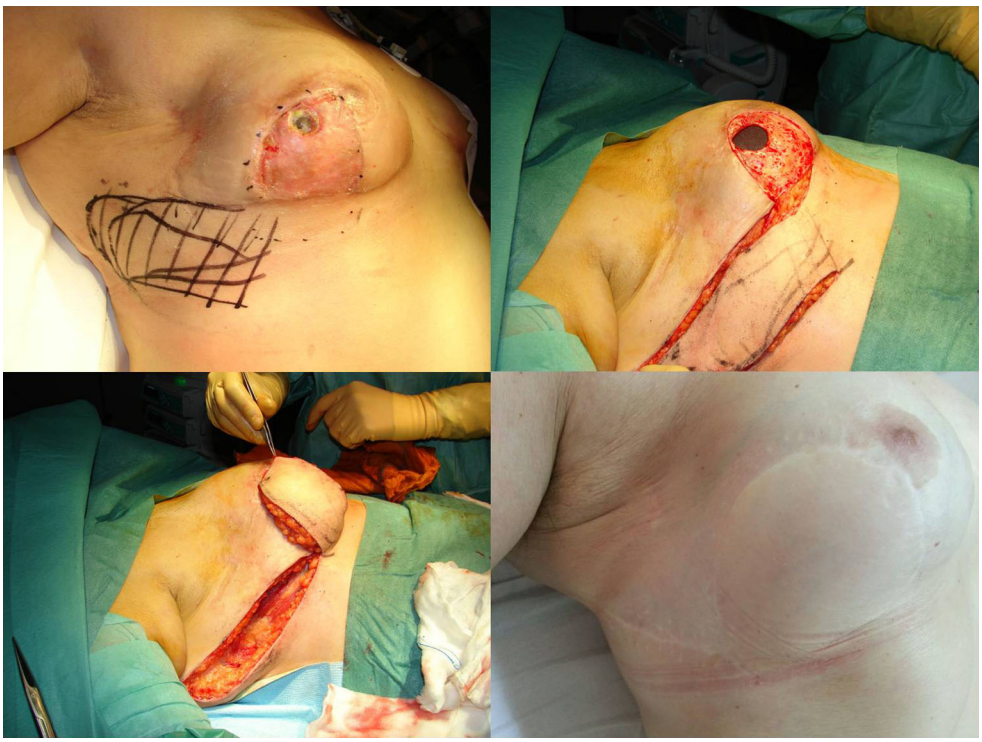

Fig. 2 Upper line of figures: Case 8. Chronic wound that resulted in a cutaneous ulcer nine years after SSM, flap design (*left*), after removal of poorly irrigated tissue and flap incisions (*right*). Lower line of figures: Case 8. Flap raised to cover the defect (*left*) and result at 2 years (*right*)

simple skin wound suture without implant removal); a hypertrophic scar was found in one case.

The follow-up period ranged from 6 months to 5 years.

Discussion

Poor tissue coverage is the main cause of breast implant loss after skin or nipple sparing mastectomy [16]. Prosthesis exposure after breast reconstruction is a surgical challenge that must be resolved immediately, or the patient is likely to lose the implant through bacterial contamination. In most cases, the cause of exposure is skin loss due to necrosis (not infection) but when the prosthesis becomes exposed, infection is a real possibility [17].

Necrosis usually results in black scarring which adheres to the healthy tissue. The scar can be left for days or weeks with only a small risk of infection but it must eventually be removed and if there is no other tissue coverage, the implant becomes exposed.

In the present study, we found that some of the patients developed a cutaneous dehiscence months after the reconstruction. A chronic fistula is the most common clinical presentation in these situations; treatment is the same, although implant replacement has to be considered.

Numerous techniques have been described in the literature for the treatment of prosthetic exposure: conservative management (primary closure or wound care with debridement and systemic or on-site antibiotics); replacement of the prosthesis associated with complete capsulotomy to reduce tension; capsular flaps [18, 19]; and a combination of muscular or cutaneous flap coverage including latissimus dorsi, lateral intercostal artery perforator LICAP [20].

Strategies for the treatment of implant exposure are sometimes very complex to plan and to achieve. In many cases, bilateral procedures, radiated skin, previous scars and immediate decision-making prevent the use of major surgical procedures (such us free flaps, major pediculated flaps or even implant removal). When the skin is severed and the implant exposed or even at risk of exposition, a decision must be taken immediately (sometimes in an emergency situation); therefore, a simple, safe and repeatable procedure is preferred

In 2004, Spears [21] studied patients with prosthetic infection or exposure and classified them into seven groups according to the degree of the infection or exposure. He created a treatment algorithm based on the initial response to treatment and the availability of covering soft tissue. The use of the pedicle latissimus dorsi muscular flap was described and recommended.

Taking into account the location of the problem and the relative simplicity of the operation, a random superior epigastric artery-dependent dermoadipose flap was the procedure that was used for the patients in this study. The use of these flaps has been described for reconstructing breast skin defects and as an alternative to TRAM, latissimus dorsi, pectoralis major flap in sternal post-operative infections [4] and even for complete breast reconstruction [22].

The superior epigastric flap is a local flap that can be used as a conventional rotating flap or an island flap; when the defect is adjacent to the submammary crease, a conventional rotating flap can be used, but when the defect is not in continuity, an island flap should be considered.

Other types of flaps have been used to cover skin defects, but we firmly believe that the random epigastric flap can be an effective solution: it is relatively simple and achieves primary defect closure with well-vascularised tissue [5] that ensures viability (even with large cutaneous defects) and allows completion of adjuvant treatment within deadlines. Furthermore, the technique has been successfully used with radiated breasts, without compromising vascularisation.

In cases of adjuvant radiotherapy, the epigastric flap usually falls away from the radiated zone and no complications related to poor flap irrigation are expected. Post-operative radiation impairs the quality of the skin and the final result of SSM and direct-to-implant reconstruction; in these cases, the addition of healthy and well-irrigated tissue to the surgical site could result in an improvement in the quality of the scar tissue.

Cutaneous flap coverage should be undertaken on discovery of prosthesis extrusion. When the skin becomes necrotic and there is a risk of extrusion, surgery should not be delayed. Scars at the flap donor site are concealed by the submammary fold, and the final shape of the breast is not impaired. In addition to the cosmetic advantages, we were able to achieve the main objective which was to save the implant.

Conclusion

Prosthesis exposure caused by skin necrosis can be a serious complication. The random epigastric flap is a simple and safe procedure that is capable of covering major skin defects that threaten skin envelope integrity and endanger a successful outcome.

Compliance with ethical standards

Conflict of interest The authors declare no conflicts of interests or disclosures.

References

1. Sisco M, Yao KA (2016) Nipple-sparing mastectomy: a contemporary perspective. J Surg Oncol 113(8):883–890
2. Sabino J, Lucas DJ, Shriver CD, Vertrees AE, Valerio IL, Singh DP (2016) NSQIP analysis: increased immediate reconstruction in the treatment of breast cancer. Am Surg 82(6):540–545
3. Noguchi M, Fukushima W, Ohta N et al (1992) Oncological aspect of immediate breast reconstruction in mastectomy patients. J Surg Oncol 50(4):241–246
4. Babiera G, Simmons R (2010) Nipple-areolar complex-sparing mastectomy: feasibility, patient selection, and technique. Ann Surg Oncol 3:245–248
5. Munhoz AM, Montag E, Filassi JR, Gemperli R (2014) Immediate nipple-areola-sparing mastectomy reconstruction: an update on oncological and reconstruction techniques. World J Clin Oncol 10(3):478–494
6. Lardi AM, Ho-Asjoe M, Mohanna PN, Farhadi J (2014) Immediate breast reconstruction with acellular dermal matrix: factors affecting outcome. J Plast Reconstr Aesthet Surg 67(8):1098–1105
7. Agrawal A, Sibbering DM, Courtney CA (2013) Skin sparing mastectomy and immediate breast reconstruction: a review. Eur J Surg Oncol 39(4):320–328
8. Spear SL, Seruya M (2010) Management of the infected or exposed breast prosthesis: a single surgeon's 15-year experience with 69 patients. Plast Reconstr Surg 125(4):1074–1084
9. Xue AS, Kania KE, Brown RH, Bullocks JM, Hollier LH Jr, Izaddoost SA (2016) Salvage of infected prosthetic breast reconstructions. Semin Plast Surg. 30(2):55–59
10. Malavaud S, Reme C, Gangloff D, Roques C, Chavoin JP (2005) Surgical site infection surveillance in breast implants surgery. Ann Chir Plast Esthet 50:134–137
11. Logan Ellis H, Asaolu O, Nebo V, Kasem A (2016) Biological and synthetic mesh use in breast reconstructive surgery: a literature review. World J Surg Oncol 21:121
12. Xue AS, Kania KE, Brown RH, Bullocks JM, Hollier LH Jr, Izaddoost SA (2016) Salvage of infected prosthetic breast reconstructions. Semin Plast Surg. 30(2):55–59
13. Hamdi M, Van Landuyt K, Ulens S, Van Hedent E, Roche N, Monstrey S (2009) Clinical applications of the superior epigastric artery perforator (SEAP) flap: anatomical studies and preoperative perforator mapping with multidetector CT. J Plast Reconstr Aesthet Surg 62(9):1127–1134
14. Spira M (1977) Subcutaneous mastectomy in the large ptotic breast. Plast Reconstr Surg 59(2):200–205
15. Hoffman S, Simon BE, Kahn S (1979) Alternatives to subcutaneous mastectomy. Plast Reconstr Surg 64(2):214–220
16. Schmauss Daniel, Machens Hans-Günther, Harder Yves (2015) Breast reconstruction after mastectomy. Front Surg. 2:71
17. Albright SB, Xue AS, McKnight A, Wolfswinkel EM, Hollier LH Jr, Brown RH, Bullocks JM, Izaddoost SA (2016) One-step salvage of infected prosthetic breast reconstructions using antibiotic-impregnated polymethylmethacrylate plates and concurrent tissue expander exchange. Ann Plast Surg 77(3):280–285
18. Persichetti P, Segreto F, Pendolino AL et al (2014) Breast implant capsule flaps and grafts: a review of the literature. Aesthetic Plast Surg 38:540–548
19. Gargano F, Ciminello F, Podda S et al (2009) Salvage of exposed breast implant using capsular flaps. Eplasty 9:41
20. Hamdi M, Spano A, Van Landuyt K, D'Herde K, Blondeel P, Monstrey S (2008) The lateral intercostal artery perforators: anatomical study and clinical application in breast surgery. Plast Reconstr Surg 121(2):389–396

21. Spear SL, Howard MA, Boehmler JH, Ducic I, Low M, Abbruzzesse MR (2004) The infected or exposed breast implant: management and treatment strategies. Plast Reconstr Surg 113(6):1634–1644

22. Hamdi M, Spano A, Van Landuyt K, D'Herde K, Blondeel P, Monstrey S (2008) The lateral intercostal artery perforators: anatomical study and clinical application in breast surgery. Plas Recons Surg 121:389–396