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ORIGINAL ARTICLE BREAST SURGERY

Breast Reduction: The Superolateral Dermoglandular Pedicle Revisited

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Abstract

Background Breast hypertrophy, generally found in association with ptosis, is a common problem in postadolescent women. Beyond the psychological burden of excessively heavy, droopy breasts, physical symptoms compound the condition, with neck, shoulder and back pain. Reduction mammaplasty is one of the most common cosmetic operations, especially to improve patient's musculoskeletal symptoms, with proven benefits in patient satisfaction and self-esteem postoperatively. Multiple techniques exist for breast reduction, with no clear evidence of benefit of one over another.

Methods We review the senior author's experience in using a superolateral pedicle for breast reduction in 726 patients over the past 40 years. Over the past 10 years, the technique has also been adapted for simultaneous augmentation–mastopexy, especially in post-bariatric surgery patients. Benefits include recruitment of lateral breast tissue to fill the upper pole and correct axillary fullness. The technique has the advantages of ease of execution and a low complication rate.

Results Complete data were available for 397 patients. Resection weights varied from 380 to 1248 g, and mean sternal notch–nipple distance was 25.3 cm. Mean follow-up was 22 months. Complications were uncommon: four cases of partial nipple-areola complex loss, dehiscence in 14 patients, three hematomas and seven cases of superficial surgical site infection. Nipple sensitivity was decreased in eight patients, and three patients were unable to breastfeed following surgery. Revision surgery was requested by 14 patients.

Conclusions Breast reduction using the superolateral dermoglandular flap is easy to execute, versatile, safe and effective, preserving physiological functions, and is an excellent option when treating patients with medium-to-large breasts.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Breast reduction · Mammaplasty · Pedicle · Vascular · Blood supply · Breast surgery · Nipple-areola complex · Flap

Introduction

Breast reduction is one of the most common cosmetic surgery operations in the world, with over 465,000 performed in 2016 [1], and is the fifth most common plastic surgery operation in Brazil [2]. With the increase in both the age and body mass index (BMI) of the global population, demand for reduction mammaplasty is expected to grow.

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Multiple techniques for breast reduction exist [3–6], sharing some basic principles: a decrease in volume/weight, which ameliorates patient symptoms [7–10]; maintenance of sensation and breastfeeding ability, and an improvement in shape and symmetry [11, 12]. A difficulty in understanding and lack of both an adequate three-dimensional model of the geometry of the breast and a universal classification system for breast hypertrophy contribute to the controversy in approaches to breast reduction.

Reduction mammaplasty techniques are numerous, which demonstrate the lack of solid evidence for selecting one approach over the other available options [13, 14]; unsatisfactory results with established techniques have motivated surgeons to enhance techniques over the past century [15].

In planning a reduction mammaplasty, safety of the nipple-areola complex (NAC) pedicle is the foremost concern, along with the obvious goals of obtaining an aesthetically pleasant shape: The ideal operation would obtain a decrease in the footprint, resection of excess skin and parenchyma, adequate upper pole volume and projection, along with correct NAC positioning, with the desirable 45:55 upper to lower pole proportion [16]. When feasible, shorter scars may be desirable, but most women are willing to accept slightly longer IMF scars if necessary to obtain a better cosmetic outcome. Longer scars are generally necessary in cases of breasts with a wide footprint or in patients with a large lateral or axillary tissue excess [17].

Multiple techniques for breast reduction to enhance the upper pole and to give a more conical shape to the breast have been described. With the exception of free nipple grafting (FNG), all techniques are based on axial pedicles to elevate the NAC, with a well-defined arterial supply. Different skin markings and parenchymal resection patterns may be associated with multiple pedicles for NAC transposition (inferior, superior, lateral or medial). The technique we describe takes advantage of the robust blood supply of the superolateral pedicle; the inclusion of dermoglandular tissue further helps guarantee inclusion of the NAC-supplying arteries and venous outflow.

The senior author has used a superolateral dermoglandular pedicle for NAC transposition for the past 40 years [18–20], with low complication and revision rates.

Materials and Methods

A retrospective chart review was performed of 726 women operated on by the senior author using a superolateral NAC pedicle for breast reduction from June 1981 to December 2016. Complete data were available for 397 patients. Inclusion criteria were women 16 years or older, BMI $<$ 35, with medium-to-large breast hypertrophy, with no significant coexisting medical problems which would preclude operation. Smokers were advised to stop for at least 4 weeks prior to surgery and 2 weeks postoperatively. All patients underwent preanesthetic clinical evaluation and either breast ultrasound, for patients under 40 years of age, or mammogram. Patients with a Breast Imaging Reporting and Data System (BIRADS) score $>$ 2 were referred to a breast specialist for evaluation prior to surgery. This study was performed in accordance with the Declaration of Helsinki for research in human subjects and subsequent amendments. All patients provided written informed consent for surgery and use of photographs and video. STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines were followed for manuscript preparation.

Surgical Technique

Preoperatively, point A is marked on the anterior projection of the inframammary fold (IMF) ("Pitanguy's point") [21]. The IMF is marked and checked for symmetry. The breast midline is marked at the clavicles, 5–6 cm lateral to the sternal notch. Points B and C are marked by a pinch test, which allows the surgeon to check with the patient an approximate desired breast size. For a "medium" size, the vertical length is normally 9 cm from A to C and 10 cm from A to B, 1 cm longer laterally to account for skin stretching to pull lateral tissue toward the midline. Next, the superolateral NAC pedicle is marked (Figs. 1 and 2).

Prior to anesthetic induction, intravenous antibiotics are given. Incisions and the inferior pole are infiltrated with a 1:200,000 solution of normal saline and adrenaline; care is

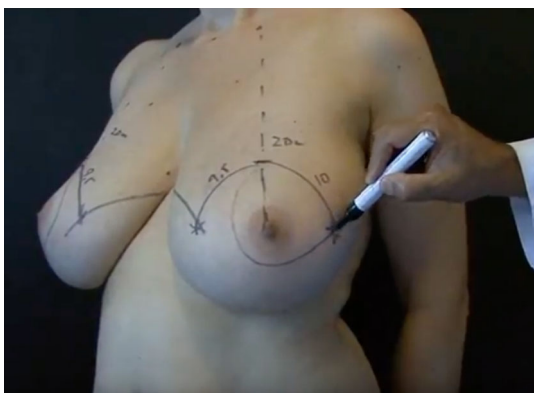

Fig. 1 Preoperative markings for a patient with significant breast hypertrophy. Point "A" is the anterior projection of the inframammary fold. The distance "AC" ("A" to lateral extent of vertical incision) should be longer than "AB" (medial portion of vertical incision)

Fig. 2 Intraoperative superolateral pedicle marking

taken to avoid infiltrating the NAC pedicle. After 15 min to allow for adequate vasoconstriction, the nipple is marked with a 38 mm or 42 mm cookie cutter, depending on breast size, and the pedicle is de-epithelialized (Fig. 3).

The pedicle is incised with a 22 blade down to pectoralis major fascia. The remaining medial tissue is resected en bloc along with the inferior pole (Fig. 4).

A submammary tunnel is undermined up to the 2nd intercostal space, allowing for accommodation of the dermoglandular flap, which will fill the upper pole (Fig. 5).

The NAC is rotated approximately 90° to fill out the tunnel and fixed at the upper pole with a 2–0 nylon suture (Fig. 6). The breast tissue elevated with the pedicle is brought upward and fixed superiorly to the pectoralis major fascia using 2–0 nylon sutures; next, the medial and lateral pillars are approximated with 2–0 nylon, to reshape the breast cone. Closure is performed with simple interrupted subcutaneous 3–0 nylon sutures and a subdermal suture with 3–0 Monocryl (Ethicon, Johnson & Johnson, Somerville, NJ). At this point, if there is excess fat laterally, liposuction is performed with a 3-mm cannula (Fig. 7). The NAC pedicle is positioned, with the inferior areolar border 5–6 cm from the IMF and the superior areolar border 16–20 cm from the sternal notch, depending on the patient's height. Closure is performed with running subcuticular 4–0 Monocryl. The incisions are dressed with moist gauze; these are removed after 24 h, and paper tape (Micropore™, Nexcare, 3M, Maplewood, MN) is placed to keep tension off the incisions; these are changed every 2 weeks and left in place for 90 days. Figures 8, 9 and 10 show pre- and postoperative views of patients who underwent breast reduction using this technique.

Over the past 10 years, we have seen increasing numbers of patients requiring augmentation–mastopexy. The superolateral pedicle is our routine choice for mastopexy, especially in patients with significantly laterally displaced breasts, such as post-massive weight loss patients. Markings are same as described above for breast reduction. We initially create the full-thickness NAC pedicle and then raise the pectoralis major muscle to create a dual plane pocket. Due to the degree of dissection between the muscle–parenchyma interface, the overwhelming majority of these mastopexy cases end up being a type 2–3 dual plane (i.e., pectoralis rises above the NAC). The added protection offered by partial submuscular implant placement is a definite advantage, as well as the additional parenchyma for patients who have poor upper pole soft tissue thickness (pinch test < 2 cm). Figure 11 shows a patient who underwent simultaneous augmentation–mastopexy using a superolateral NAC pedicle.

Supplemental digital content 1 (video 1) shows preoperative markings and the surgical technique for breast reduction.

Results

Out of 726 patients who underwent a breast reduction or augmentation–mastopexy with a superolateral pedicle by the senior author, complete data were available for 397 patients (54%—794 breasts). Bilateral tissue resection weights varied from 380 to 1448 g, with a mean of 460 g. Sternal notch-to-nipple distance varied from 22 to 42 cm, with a mean of 25.3 cm. Operative time varied from 117 to

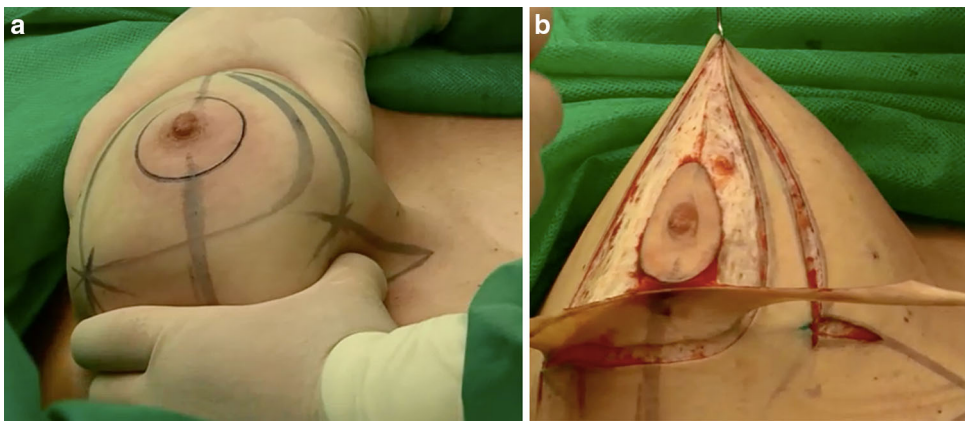

Fig. 3 Pedicle de-epithelialization

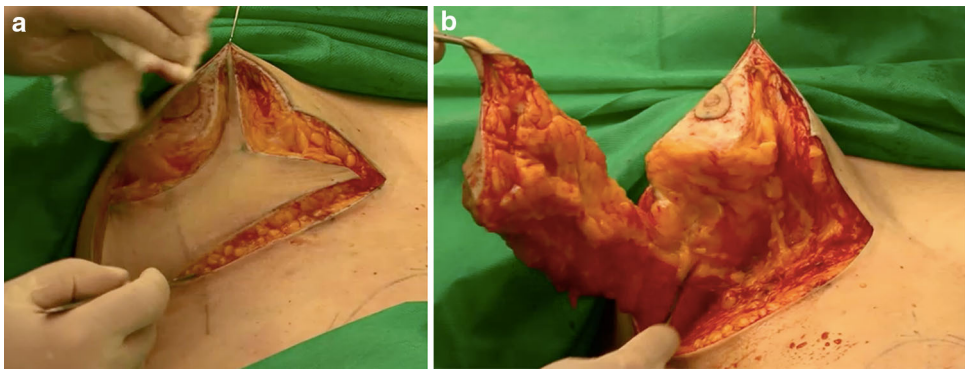

Fig. 4 *En bloc* resection of lower pole and medial breast

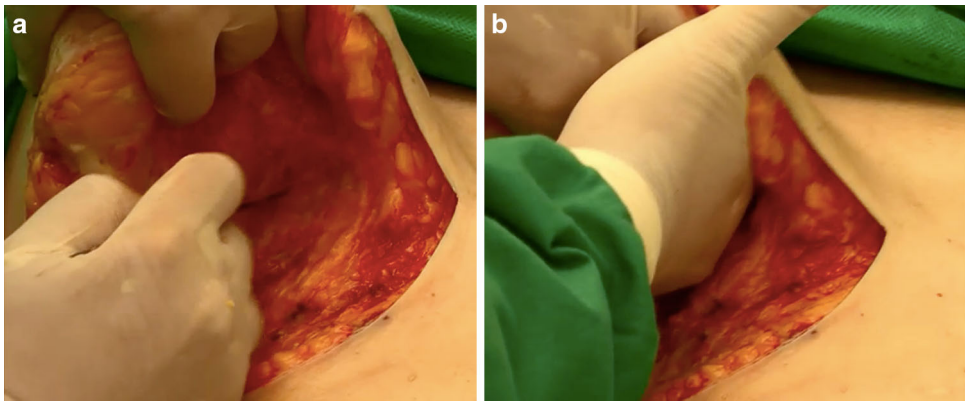

Fig. 5 Tunnel undermining up to the second intercostal space

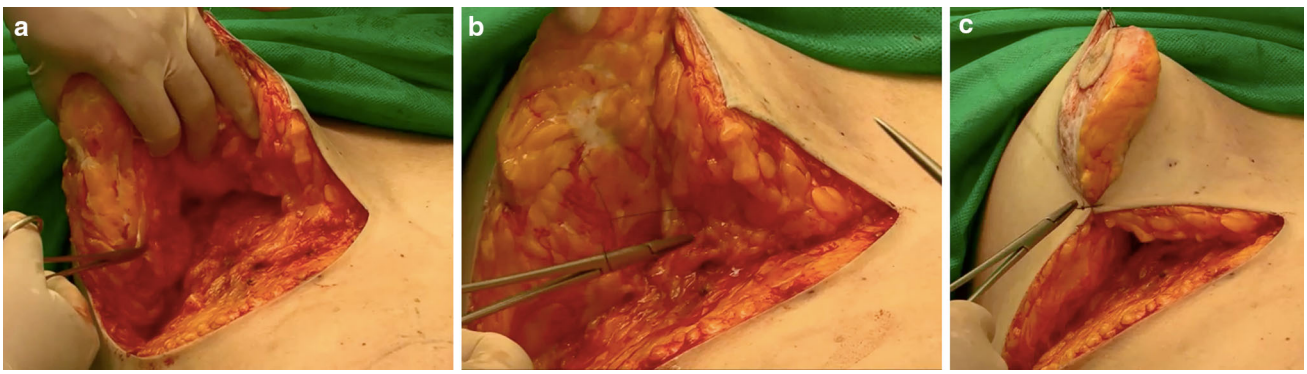

Fig. 6 **a–c** The medial and lateral breast pillars are clearly visualized. The superolateral pedicle is rotated upward to fill out the upper pole and to bring the nipple-areola complex (NAC) to its new position

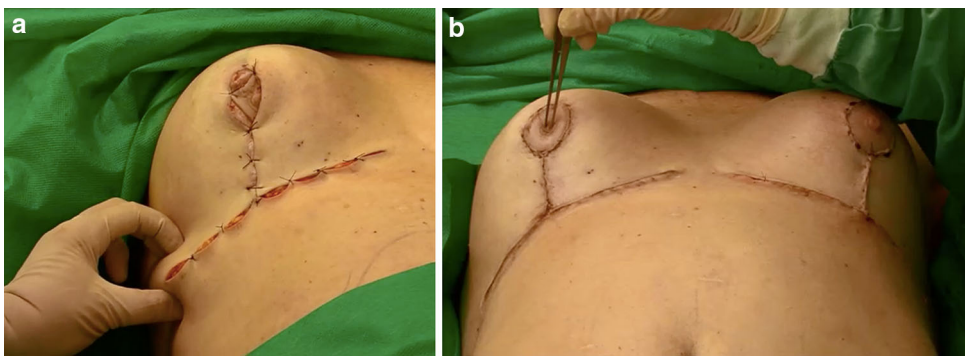

Fig. 7 **a** New breast shape and excess lateral fat shown. **b** Immediate postoperative result at the end of surgery with adequate arterial inflow and venous outflow to the NAC. Excess lateral fat has been aspirated, and adequate lateral breast and chest wall contour are evident

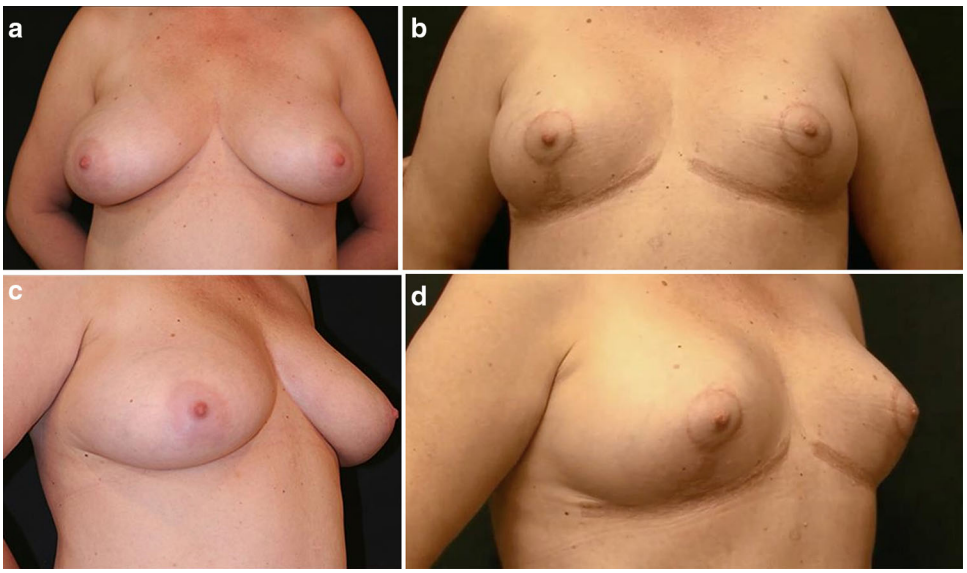

Fig. 8 **a–d** Preoperative (left) and 60-day postoperative results (right) of the 52-year-old patient from Fig. 2, with adequate upper pole fullness and NAC appropriately positioned on the breast mound. Skin-colored paper tape covering the incisions is seen and is kept for 90 days

Fig. 9 **a–c** Preoperative (above) and 2-year postoperative results (below) of a 33-year-old, G2P2 woman who underwent a superolateral pedicle breast reduction, with a total resection weight of 570 g

218 min, with a mean of 142 min. Mean follow-up was 22 months [12–220 months] (Table 1).

Complications included four cases (1%) of partial unilateral NAC loss (Fig. 12), none of which requested revision surgery or other treatment. Dehiscence occurred in 14 patients (3.5%); 4 (1%) were significant enough to require resuturing in the clinic with local anesthesia, while the others were treated with local wound care (Vaseline gauze) and healed by secondary intention. There were no cases of implant loss in the augmentation–mastopexy group. Small, localized hematomas occurred in three patients (0.75%), all of which were treated with aspiration only; none required exploration in the operating room. There were seven cases (1.7%) of superficial surgical site infections, treated with topical and oral antibiotics; none required hospital admission nor intravenous antibiotics.

Hypertrophic scars or keloids occurred in 24 patients (6%); 6 of these (1.5%) improved with silicone taping. Out of the other 18 patients, 10 (2.5%) were treated additionally with triamcinolone injections and 4 (1%) underwent radiation therapy (betatherapy). Ultimately, 10 patients (2.5%) underwent surgical scar revision, with application of intralesional triamcinolone intraoperatively and silicone taping starting at postoperative week 2.

Eight patients (2%) reported decreased nipple sensitivity. Three patients (0.75%) complained of inability to breastfeed following surgery. Fourteen patients (3.5%) requested revision of their operation due to inadequate volume resection or dissatisfaction with breast shape. Ten patients (2.5%) required revision after significant weight loss (mean 10 kg), after an average of 3 years.

Discussion

Breast reduction continues to be one of the most challenging cosmetic operations, due to the interplay between patient's skin, breast parenchyma and chest wall characteristics, which can influence immediate and long-term results.

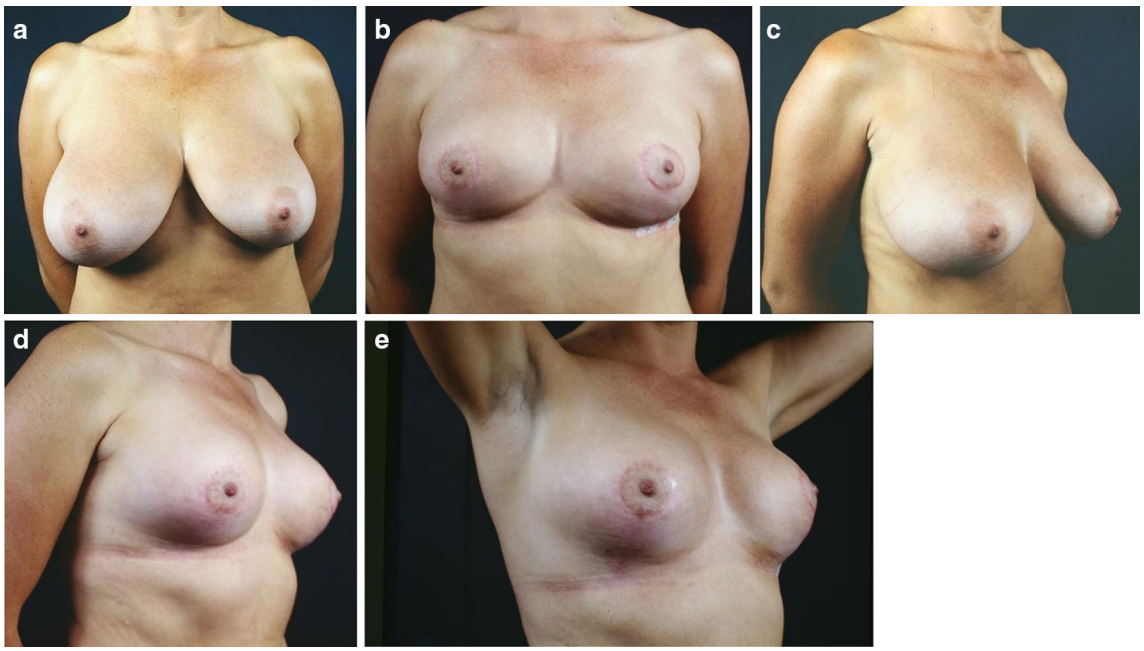

Fig. 10 **a–e** Fifty-three-year-old patient with breast asymmetry and hypertrophy, who underwent a superolateral pedicle breast reduction. Preoperative (**a**, **c**) and 7-month postoperative views (**b**, **d**). Arms elevated to show the new, conical shape (**e**). Rotation of the superolateral dermoglandular flap allows for the rounded shape of the lateral breast

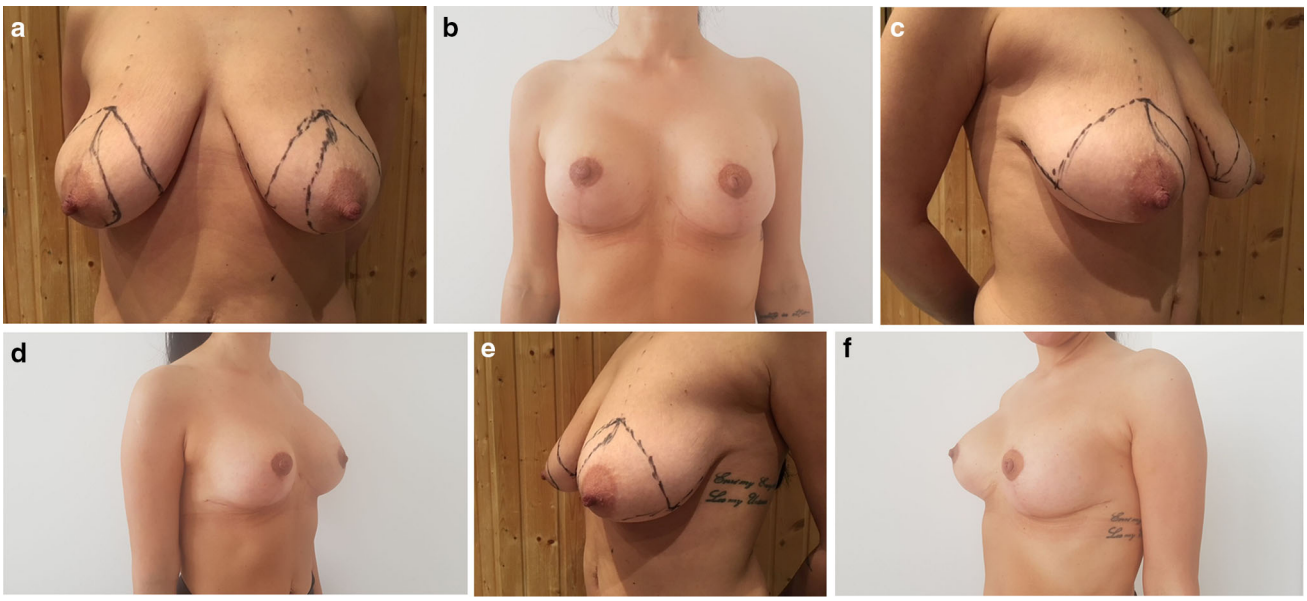

Fig. 11 **a–f** Preoperative (**a–c**) and 6-month postoperative views (**d–f**) of a 38-year-old woman, G1P1, with breast ptosis after significant weight loss (18 kg). She underwent augmentation–mastopexy using a superolateral pedicle and a dual plane implant placement (220 cc round, silicone gel implants). Resection weight was 320 g from the right breast and 340 from the left

Surgical correction of breast hypertrophy, with or without ptosis, has been shown in multiple studies to improve patient complaints, including physical discomfort (back and shoulder pain), poor posture, premenstrual cycle pain, psychological problems and acromioclavicular deformities.

With aging and a decrease in estrogens, breast parenchyma becomes increasingly fattier, and a loss of support of the breast mound occurs, with distended Cooper's ligaments no longer able to suspend the breast off the chest wall. Previous pregnancy and significant weight loss compounds the problem.

Table 1 Patient characteristics, complications and results

	Total (range)	Percentage (%)
Number of patients	397	100
Breast reduction	352	88.7
Augmentation–mastopexy	45	11.3
Mean operative time (min)	142 (117–218)	
Mean age (years)	36 (16–74)	
Mean BMI (kg/m^2)	26.8 (19.3–33.2)	
Mean total resection weight (g)	460 (380–1248)	
Mean sternal notch–nipple distance (cm)	25.3 (22–42)	
Mean follow-up (months)	22 (12–220)	
Complications		
Unilateral partial NAC necrosis	4	1
Dehiscence	14	3.5
Hematoma	3	0.75
Superficial surgical site infection	7	1.7
Hypertrophic/keloid scar	24	6
Decreased nipple sensitivity	8	2
Inability to breast feed	3	0.75
Need for revision		
Inadequate volume resection/poor shape	14	3.5
Postoperative weight loss/ptosis	10	2.5

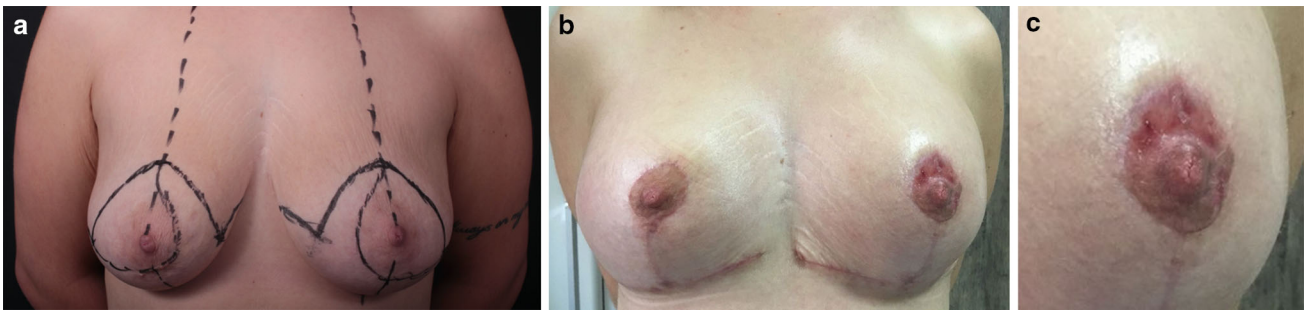

Fig. 12 **a** Preoperative view of a 36-year-old woman, G2P2, who lost 32 kg through lifestyle modifications. She underwent simultaneous augmentation–mastopexy with a superolateral pedicle and 200 cc round, silicone gel implants. She developed partial loss of the left NAC and later admitted to smoking prior to and after surgery (which she denied during preoperative evaluation). **b**, **c** Appearance of NAC at 3 months postoperative. The patient desired no further intervention, although micropigmentation was proposed

Multiple NAC pedicles have been described over the years for breast reduction, with no one technique demonstrating clear superiority over the others: superomedial pedicles, such as described by Bostwick, Hall-Findlay [14] and previously by Silveira Netto [22]; inferior pedicles include those by Ribeiro [11]; superior pedicles include the classic Pitanguy [3, 23], Marchac [24], Regnault [25], Bozola [26], Chiari [27], Lassus [28], Lejour [29], Benelli [30] and others.

Central mound techniques include those by Peixoto [31] and Sampaio Góes [32].

Another option for NAC elevation is horizontal pedicles, the classic descriptions including the horizontal bipedicle by Strombeck, a vertical bipedicle by McKissock [4], transverse pedicles (Pitanguy [6]) or a combination of both, such as in papers by Ribeiro [11], and Graf [33].

Lateral pedicles, the focus of our technique, are illustrated by the classic Skoog technique [34], as well as Strauch [35], Blomqvist [36], Cárdenas-Camarena [37, 38] and Blondeel [15].

The lateral NAC pedicle described by Skoog in 1963 is derived from early anatomical studies by Cooper [39], which were confirmed by Marcus in 1934 [40], demonstrating the robust lateral arterial supply. It could be argued that the Skoog technique is basically a modified Strombeck technique [41] with a transection of the medial pedicle, keeping the superior-external base, with NAC transposition by rotation of a dermal flap to the new nipple location.

Skoog's initial design utilized only a thin dermal pedicle; however, after observing venous congestion in some cases, he opted to design a more pyramidal pedicle, thicker at the base. Significantly, he never incorporated glandular tissue into the pedicle, for fear that, in case of vascular compromise and resultant steatonecrosis, the entire structure and shape of the breast could be deformed [42]. Skoog's original technique resulted in decreased nipple sensation in most patients, some of which improved after the first year; this finding was also confirmed by Cárdenas-Camarena [37], who subsequently described a similar technique using a full-thickness superior-lateral pedicle.

In contrast to the technique described by Blondeel et al., in which there is minimal undermining of the centro-lateral NAC pedicle, the superolateral pedicle we describe allows for greater contouring of the lateral breast, as this tissue is brought medially and superiorly, through the undermined tunnel, to fill the upper pole, allowing for an improved overall breast shape. Liposuction of the axillary fat excess can be done to improve breast contour.

Anatomical studies by O'Dey et al. [43] demonstrate that the most constant and robust irrigation to the NAC comes from branches off of the external mammary artery (lateral thoracic artery). This artery was found in 100% of cadaver dissections, while the internal mammary artery irrigated the NAC in 86% of specimens. Since the internal mammary perforators enter the NAC at approximately 1 cm deep to the dermis, excessively thin flaps put NAC viability at risk.

As previously described, pedicle thickness is as important as its origin, because 93% of the cutaneous branches from the lateral nerves are deep branches penetrating the pectoralis fascia, whereas only 7% follow a superficial course. Therefore, by preserving the full thickness of the breast along with the pedicle, nerve integrity is also ensured [44]. Current best practice for preservation of nipple sensitivity in breast reduction should thus be based on attention to the positioning and depth of incisions on the breast rather than the amount of tissue resected [45].

When a thin, dermal pedicle is used, lactiferous ducts are inevitably sectioned, however, in a study by Cruz and Korchin [46], patients with breast hypertrophy from a control group had similar lactation capacity compared to patients submitted to breast reduction with a superior, medial or inferior pedicle, at approximately 62–65%, with no difference between groups; loss of NAC sensation was 2%. In summary, the lateral dermoglandular pedicle is an excellent choice, allowing for lactation and preservation of NAC sensation [47, 48].

Historically, the extent of tissue resection was considered the main factor affecting NAC sensation; however, more recently, the technique used for the pedicle is considered the defining factor [49]. The fourth intercostal nerve is the most important for NAC sensitivity and may be affected by the design of the pedicle; however, cutaneous branches of the third and fifth intercostal nerves also contribute. Schlenz et al. [50], in a cadaver study, found the lateral cutaneous branch of the fourth intercostal nerve to be the most constant and significant innervation to the NAC, in 93% of cases. The anterior cutaneous branches of the third and fourth intercostal nerves were present in 57% of dissections. This significant contribution of the lateral intercostal nerve branches corroborates the decision to use a superolateral pedicle for breast reduction. The nipple is innervated by 3–5 lateral and anterior cutaneous branches arising from the fourth intercostal nerve. The anterior cutaneous branches follow a superficial course through the subcutaneous tissue and terminate at the medial border of the areola. The fourth intercostal nerve pierces the fifth rib fascia at the lateral border of PMM and heads toward the NAC from an inferior and lateral position, entering at approximately an 8 o'clock position on the right breast and a 4 o'clock position on the left [51]. The lateral cutaneous branches course deep to the pectoralis fascia and reach the nipple on its posterior aspect in 93% of patients. Degree of breast ptosis and hypertrophy have not been found to alter the course of the NAC nerve supply. Therefore, a superolateral pedicle can be considered safer with regard to the preservation of NAC sensitivity compared to a purely central pedicle.

In a recent study by Muslu et al. [52], patients who underwent inferior pedicle breast reduction had decreased sensation to the superior-medial and inferior-lateral quadrants; however, two-point discrimination and pain sensation were similar in both groups.

Fifty percent of patients with reduced nipple sensitivity and 65% of patients with total loss of nipple erectibility and sensitivity present with these complaints after the initial 6 months following surgery, when attention changes from satisfaction with new breast size and relief of preoperative symptoms to complaints about sensation; loss of sensation to light touch and a loss of erectibility, which are generally concomitant, are the most bothersome changes to most patients. During preoperative discussion with patients, it is important to point out that most patients with breast hypertrophy present with decreased NAC sensation preoperatively [53]. The cause is multifactorial, including traction neuropraxia from the excessive weight and length of the breast, decreased nerve density and dissatisfaction with body image [54].

A significant contribution to further understanding breast anatomy was made by Wuringer et al. [55], who described the presence of a thin horizontal fibrous septum, which was found in 28 cadavers. This septum emerges from the pectoralis fascia at the level of the fifth rib and crosses the breast from medial to lateral. The authors also

confirmed the NAC innervation, from a deep branch of a lateral cutaneous branch of the intercostal nerve, running inside the septum. Out of 12 breasts studied, the nerve originated from the fourth intercostal branch in 10 cases, and from the fifth intercostal branch in two breasts. There is no consensus, though, as to the best option for maintenance of nipple sensation, with some studies demonstrating an inferior pedicle to have improved sensation compared to a superior pedicle, while other studies fail to demonstrate any difference among pedicle techniques [56].

The authors also demonstrated the importance of the superficial lateral portion of this septum/ligament. When pulling this portion of the septum medially and superiorly, the axillary hollowing was accentuated, helping correct the lateral breast prolongation. This is significant and is noted clinically when we perform the technique we describe.

Multiple attempts to evaluate breast aesthetics have been described, but a recent mnemonic-based system [57] proposes a systematic analysis: BFACE (bones, footprint, areola, conus, envelope). The senior author sought to improve results of breast reduction by enhancing the superolateral pedicle technique; all aspects (apart from the bones) of the BFACE mnemonic can be improved, and the technique also allows for correction of one of the most bothersome areas to patients, which is the lateral chest wall/axillary breast extension. The safety of the NAC pedicle is one of the foremost concerns, and even breasts with significant ptosis and a need to raise the NAC over long distances can be safely operated with this technique. Additionally, the rotation of the lateral breast tissue medially and superiorly allows the upper pole to be adequately filled, offering excellent projection and fullness.

As with other studies on breast reduction, the lack of a standardized scale to assess the degree of hypertrophy and patient's soft tissue characteristics does not allow for direct comparison between patients nor between cohorts operated on by different surgeons. The difficulty in adequately controlling for factors such as soft tissue quality, resection weight and postoperative care all but precludes the possibility of conducting randomized trials with different breast reduction techniques.

Conclusion

The definitive breast reduction technique continues to elude plastic surgeons. We have revisited the superior-lateral NAC pedicle breast reduction building on the previous senior author works and from others contributions (work of previous authors). The technique may help to preserve the ability to breastfeed and nipple sensation, is simple to execute, improves the axillary extension and upper pole contour and gives excellent NAC projection, achieving very good patient satisfaction, as evidenced by a low revision rate. The operation should be an option when treating patients with medium-to-large breast hypertrophy.

Compliance with Ethical Standards

Conflict of interest The authors have no conflicts of interest, commercial associations or financial interests to disclose.

Ethics Statement All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

References

1. International Society of Aesthetic Plastic Surgery (2016). https://www.isaps.org/wp-content/uploads/2017/10/GlobalStatistics.WorldWide.Summary2016s-1.pdf. Accessed June 8, 2018
2. Brazilian Society of Plastic Surgery (2017). http://www2.cirurgiaplastica.org.br/2017/10/27/estetica-procura-por-procedimentos-nao-cirurgicos-aumenta-390/. Accessed June 8, 2018
3. Pitanguy I (1967) Surgical treatment of breast hypertrophy. Br J Plast Surg 20:78–85
4. McKissock PK (1972) Reduction mammaplasty with a vertical dermal flap. Plast Reconstr Surg 49:245–252
5. Strömbeck JD (1960) Mammaplasty: report of a new technique based on the two pedicle procedure. Br J Plast Surg 13:79–80
6. Pitanguy I (1962) Une nouvelle technique de plastie mamaire. Étude de 245 cas consecutifs et presentation dune technique personelle. Ann Chir Plast 7:199–208
7. Letterman G, Schurter M (1980) The effects of mammary hypertrophy on skeletal system. Ann Plast Surg 5:425–431
8. Gonzalez F, Walton RL, Shafer B, Borah GL (1993) Reduction mammaplasty improves symptoms of macromastia. Plast Reconstr Surg 91:1270–1276
9. Bruhlmann Y, Tschopp H (1998) Breast reduction improves symptoms of macromastia and has a long-lasting effect. Ann Plast Surg 41:240–245
10. Blomqvist L, Eriksson A, Brandberg Y (2000) Reduction mammaplasty provides long-term improvement in health status and quality of life. Plast Reconstr Surg 106:991–997
11. Ribeiro L (1975) A new technique for reduction mammaplasty. Plast Reconstr Surg 55:330–334
12. Mofid MM, Dellon AL, Elias JJ et al (2002) Quantitation of breast sensibility following reduction mammaplasty: a comparison of inferior and medial pedicle techniques. Plast Reconstr Surg 109:2283–2288
13. Wechselberger G, Stoss S, Schoeller T et al (2001) An analysis of breast sensation following inferior pedicle mammaplasty and the effect of the volume of the resected tissue. Aesthet Plast Surg 25:443–446
14. Hall-Findlay EJ (1999) A simplified vertical reduction mammaplasty: shortening the learning curve. Plast Reconstr Surg 104:748–759
15. Blondeel PN, Hamdi M, Sijpe KAV (2003) The latero-central glandular pedicle technique for breast reduction. Br J Plast Surg 56:348–359
16. Mallucci P, Branford OA (2014) Population analysis of the perfect breast: a morphometric analysis. Plast Reconstr Surg 134:436–447
17. Ariê G (1957) Una nueva técnica de mastoplastia. Rev Latinoam Cir Plast 3:23–31

18. Uebel CO (1978) Breast reduction with the lateral dermo-glandular rotation flap. In: Annals of the XVth Brazilian congress of plastic surgery, São Paulo, SP
19. Uebel CO (2011) Breast reduction using the supralateral dermoglandular flap. IPRAS J 3:16–17
20. Uebel CO (2013) Combined abdominal contouring and mastopexy. In: Rubin JP, Jewell ML, Richter DF, Uebel CO (eds) Body contouring and liposuction. Elsevier Saunders, Philadelphia
21. Pitanguy I (1981) Reduction mammoplasty. Aesthetic plastic surgery of the head and body. Springer, Berlin
22. Silveira Netto E (1976) In: Ely JF (ed) 13 Congresso Bras Cir Plástica. Mastoplastia redutora sectorial com pediculo areolar interno, pp 13–15. Porto Alegre
23. Pitanguy I (1962) A new technic of plastic surgery of the breast. Study of 245 consecutive cases and presentation of a personal technic. Ann Chir Plast 7:199–208
24. Marchac D, de Olarte G (1982) Reduction mammaplasty and correction of ptosis with a short inframammary scar. Plast Reconstr Surg 69:45–55
25. Regnault P (1980) Breast reduction: B technique. Plast Reconstr Surg 65:840–845
26. Bozola AR (1990) Breast reduction with short L scar. Plast Reconstr Surg 85:728–738
27. Chiari A Jr (2001) The L short-scar mammaplasty: 12 years later. Plast Reconstr Surg 108:489–495
28. Lassus C (1987) Breast reduction: evolution of a technique—a single vertical scar. Aesthetic Plast Surg 11:107–112
29. Lejour M (1994) Vertical mammaplasty and liposuction of the breast. Plast Reconstr Surg 94:100–114
30. Benelli L (1990) A new periareolar mammaplasty: the ''round block'' technique. Aesthet Plast Surg 14:93–100
31. Peixoto G (1980) Reduction mammaplasty: a personal technique. Plast Reconstr Surg 65:217–226
32. Goes JC (1996) Periareolar mammaplasty: double skin technique with application of polyglactine or mixed mesh. Plast Reconstr Surg 97:959–968
33. Graf R, Reis de Araujo LR, Rippel R et al (2003) Reduction mammaplasty and mastopexy using the vertical scar and thoracic wall flap technique. Aesthet Plast Surg 27:6–12
34. Skoog T (1963) A technique of breast reduction; transposition of the nipple on a cutaneous vascular pedicle. Acta Chir Scand 126:453–465
35. Strauch B, Elkowitz M, Baum T et al (2005) Superolateral pedicle for breast surgery: an operation for all reasons. Plast Reconstr Surg 115:1269–1277
36. Blomqvist G, Alberius P (1990) Nipple-areola transposition by the superolateral-rotation pedicle technique in reduction mammaplasty: surgical description. Ann Plast Surg 24:475–480
37. Cárdenas-Camarena L, Vergara R (2001) Reduction mammaplasty with superior-lateral dermoglandular pedicle: another alternative. Plast Reconstr Surg 107:693–699
38. Cárdenas-Camarena L (2009) Reduction mammoplasty with superolateral dermoglandular pedicle: details of 15 years of experience. Ann Plast Surg 63:255–261
39. Cooper AP (1840) On the anatomy of the breast. Longman, Orme, Green, Brown and Longmans, London
40. Marcus GH (1934) Untersuchungen uber die arterielle Blutversorgung der Mamilla. Arc Klin Chir 179:361–369
41. Strombeck JO (1964) Breast reconstruction. I. Reduction mammaplasty. Mod Trends Plast Surg 16:237–255
42. Skoog T (1974) Plastic surgery. New methods and refinements. Almqvist and Wiksell, Stockholm
43. O'Dey DM, Prescher A, Pallua N (2007) Vascular reliability of nipple-areola complex–bearing pedicles: an anatomical microdissection study. Plast Reconstr Surg 119:1167–1177
44. Mehrdad MM, Dellon AL, Elias JJ, Nahabedian MY (2002) Quantitation of breast sensibility following reduction mammaplasty: a comparison of inferior and medial pedicle techniques. Plast Reconstr Surg 109:2283–2288
45. Hamdi M, Greuse M, DeMey A, Webster MHC (2001) A prospective quantitative comparison of breast sensation after superior and inferior pedicle mammaplasty. Br J Plast Surg 54:39
46. Cruz NI, Korchin L (2007) Lactational performance after breast reduction with different pedicles. Plast Reconstr Surg 120:35–40
47. Hamdi M, Blondeel P, Van de Sijpe K et al (2003) Evaluation of nipple-areola complex sensitivity after the latero-central glandular pedicle technique in breast reduction. Br J Plast Surg 56:360–364
48. Hefter W, Lindholm P, Elvenes OP (2003) Lactation and breastfeeding ability following lateral pedicle mammaplasty. Br J Plast Surg 56:746–751
49. Souza A, Saltz R (2000) The Common Principles of Effective Breast Reduction Techniques. Aesthetic Surg J 20:213–217
50. Schlenz I, Kuzbari R, Gruber H et al (2000) The sensitivity of the nipple-areola complex: an anatomic study. Plast Reconstr Surg 105:905–909
51. Schulz S, Zeiderman MR, Gunn S et al (2017) Safe plastic surgery of the breast II: saving nipple sensation. Eplasty 17:303–312
52. Muslu U, Demirez DS, Uslu A, Korkmaz MA, Filliz MB (2018) Comparison of sensory changes following superomedial and inferior pedicle breast reduction. Aesthet Plast Surg 42:38–46
53. Greuse M, Hamdi M, DeMey A (2001) Breast sensitivity after vertical mammaplasty. Plast Reconstr Surg 107:970–976
54. Schlenz I, Rigel S, Schemper M (2005) Alteration of nipple and areola sensitivity by reduction mammaplasty: a prospective comparison of five techniques. Plast Reconstr Surg 115:743–751
55. Wuringer E, Mader N, Posch E et al (1998) Nerve and vessel supplying ligamentous suspension of the mammary gland. Plast Reconstr Surg 101:1486–1493
56. Harbo SO, Jorum E, Roald HE (2003) Reduction mammaplasty: a prospective study of symptom relief and alteration of skin sensibility. Plast Reconstr Surg 111:103–110
57. Martinovic ME, Blanchet NP (2017) BFACE: a framework for evaluating breast aesthetics. Plast Reconstr Surg 140:287–295