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In Pursuit of Effective Volume Reduction and Enhanced Aesthetics for Treatment of Gigantomastia Using Superior Dermoglandular Pedicle

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Abstract

Background Gigantomastia is defined as extreme hypertrophy of the female breast. It is a disabling condition that presents unique challenges to plastic surgeons. Initial breast volume is an important factor affecting the success of the reduction. Usually, it is difficult to achieve small-sized breasts, and long-term results are often unsatisfactory, resulting in complications such as "bottoming-out" deformities.

Methods This paper presents a case series involving 40 patients (mean age 44.2 ± 12.5) with gigantomastia. Reductions were performed by superior nipple–areola complex pedicle with or without liposuction. Total resection weight ranged from 2050 to 5398 g (mean 3066 ± 944.2). Generally, the literature emphasizes the unreliability of the long superior pedicle when used to reduce the size of very large breasts. The technical steps for this procedure have been clearly described, and ways in which to overcome technical difficulties and attain effective volume reduction with minimal complications were presented.

Results The technique described here is applicable to all gigantomastia cases; even very large, pendulous breasts could be effectively reduced. Physical symptoms rapidly improved during the early postoperative period, patients' aesthetic satisfaction scores were high (4.6/5), and none of the patients complained of flat breasts. The rate of partial areola necrosis was 5%, and the rate of complete areola necrosis was 2.5%. These rates are comparable to those in the literature.

Conclusion Using the technique described above, superior pedicle can be applied to all gigantomastia cases and enhanced aesthetic results can be obtained with minimal complications.

Level of Evidence V 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 Gigantomastia · Reduction · Breast volume · Enhanced aesthetics · Liposuction · Superior pedicle

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Introduction

The term "gigantomastia" describes a rare pathologic condition in which the breast progressively grows to an enormous size for unknown reasons [1]. Although there is no universally accepted definition for this condition, the amount of tissue resected during reduction mammaplasty is the most widely used, with threshold ranges between 1000 and 2000 g per breast [2–5]. To date, only small case reports and series have specifically addressed the surgical management of gigantomastia.

Gigantomastia is a condition that is both physically and emotionally debilitating. Various procedures for reduction mammaplasty have been described, but not all of these techniques can be applied successfully to cases of gigantomastia. Deformities such as "bottoming out" and technical limitations of breast reduction are concerns with

reduction mammaplasties performed for giant breasts [6, 7]. Additionally, because of the large amount of tissue removed, surgeons can encounter different intraoperative and postoperative complications, and the aesthetic results necessitate further refinement of most of the techniques in use today. Currently, the most dependable procedure for treating this condition is free nipple grafting [7–9].

The superior pedicle is the best technique for avoiding bottoming-out deformities. However, the literature emphasizes the unreliability of a long superior pedicle when used to treat very large breasts [2, 10]. Robbins and Hoffman for instance reported an overall nipple slough rate of 5% (and a major slough rate of 1.4%), with 3% of patients needing intraoperative conversion to a free nipple–areola graft due to vascular issues [10]. The authors recommend that it should be restricted to reductions of up to 1200 g [10]. Other researchers have noted that infolding of longer pedicles could be difficult and cause vascular issues [11] In this article, we outline an approach to marking for superior dermoglandular reduction for extremely high-volume breast reduction. The technique successfully achieved volume reduction, providing aesthetically pleasing and reproducible results.

Materials and Methods

From 2010 to 2016, 40 patients aged between 29 and 68 years (mean 44.2 ± 12.5) were surgically treated for gigantomastia using a superior pedicle with or without liposuction. Preoperative height, weight, and body mass index (BMI) were recorded for each patient. Patients' histories of comorbid conditions, breast abnormalities, including masses, and/or prior surgeries were obtained. Breast ultrasonography was performed before the surgery and annually after the surgery. All resected and aspirated specimens were weighed, and only resected materials were sent for pathologic examination.

All patients had bilateral breast reductions, with more than 1000 g of breast tissue per breast removed. Total resection weight ranged from 2050 to 5398 g (mean 3066 ± 944.2 g) (Table 1). Liposuction was performed in 29 cases (Table 1). Eleven of the patients had marked skin laxity, and therefore surgery was performed without liposuction. The mean BMI was 31.8 ± 5.0 (Table 1).

Thoracic epidural anesthesia was performed for two patients, and all others underwent general anesthesia. The postoperative follow-up included clinical examination and photographic documentation of the patients after 1 week and after 1, 3, 6, and 12 months. The postoperative follow-up period ranged from 8 months to 6 years.

Postoperatively, all patients were reached by phone and asked to rate their cosmetic and functional satisfaction with the surgery on a five-point scale: (1) very dissatisfied, (2) dissatisfied, (3) neither satisfied nor dissatisfied, (4) satisfied, or (5) very satisfied.

Operation Technique

Preoperative markings were made while the patient was standing (Fig. 1). Both breast bases were marked and measured (dashed line, Fig. 2). A straight midline was drawn from the sternal notch to the umbilicus. The clavicular point was set at 7.0–7.5 cm lateral to the midline (Fig. 2). The mid-breast meridian was marked from this clavicular point to the most dependent part of the breast, not toward the NAC (since the NAC can be severely malpositioned in extremely large breasts). This line should bisect the breast mold. The superior point of the new dome-shaped NAC opening is marked where the inframammary fold meets the corresponding anterior point. This point varies 17–22 cm depending on the height of the patient. The widest part of the areolar opening should be around 40–50% of the breast base width, and the height of the opening should be 4–5 cm. The caudal border of the areola pedicle to be epithelialized should extend at least 3–4 cm down to the areola (Fig. 3a, b).

Inferiorly, at the midline, a line 3–4 cm above and parallel to the submammarian fold is drawn (Fig. 3a, b). This line inclines and is connected to the vertical lines extending down to the areolar opening. Marks are made 7 cm from the top of these vertical lines (Fig. 3a, b). The distance from the base of the breast to these marks should be approximately 13–14 cm (Fig. 3b).

Initially, 500 ml of 0.5% lidocaine and 1:100,000 epinephrine was injected into each breast via a 2-mm multiple-hole injection cannula. Then, vigorous liposuction was performed for all parts of the breast, including the pedicle site, using liposuction cannulas with blunt tips #5 and #6 (Fig. 4). Thereafter, the periareolar skin is deepithelialized (Fig. 5). Care should be taken not to injure the subdermal venous plexus. Then, the crescent-shaped skin and parenchymal tissue is resected (Fig. 6a–c). The central breast tissue should also be removed, and the areola flap should be thinned to achieve a small-sized breast (Fig. 7). Otherwise, the pedicle can be compressed and circulation problems may arise. The thickness of the pedicle should be around 1.5–2.0 cm to allow for easy folding (Fig. 8). To obtain good projection, extra fat tissue may be left at the base of the pedicle (Fig. 9, indicated with an arrow). No undermining is performed under the medial and lateral pillars. In cases with tight breasts (usually associated with younger patients), undermining of the upper breast allowed easier inset of the areola pedicle and overcorrected the ptosis for a better shape.

Table 1 Table depicting patient initials, BMI (body mass index), age, anesthesia type, total volume removed (resection + liposuction), year of operation, comorbid situations, complications, and reoperation

Pts	BMI	Age	Anesthesia type	Total volume (gr)	Year	Comorbidity	Complication	Reoperation
1/SÖ	33.69	51	General	2200	2010	–	–	–
2/GK	29.69	40	Regional	3600	2010	–	–	–
3/Üİ	31.25	32	Regional	3100	2010	–	–	–
4/BB	30.39	44	General	2200	2011			
5/NT	34.55	59	General	1000 + 1100 = 2100	2011	DM	Seroma	–
6/AS	33.79	26	General	2630	2011	–	Fat necrosis and excess tissue	+
7/EB	25.29	20	General	960 + 1190 = 2150	2011	–	–	–
8/EE	47.59	33	General	4398 + 1000 = 5398	2011	–	Fat necrosis and excess tissue	–
9/ES	32.05	36	General	1927 + 1050 = 2977	2011	–	Seroma and excess tissue	+
10/EB	24.44	24	General	2150 + 900 = 3050	2011	–	–	–
11/FN	31.18	42	General	2200 + 600 = 2800	2011	–	–	–
12/NC	30.86	62	General	2720 + 1650 = 4370	2012	–	Excess tissue	+
13/GS	28.57	47	General	1400 +650 = 2050	2012	–	–	–
14/DY	34.72	50	General	2662	2012	–	–	–
15/HG	30.43	57	General	1618 + 1250 = 2868	2014	–	Excess tissue	+
16/MK	27.55	49	General	1824 + 1375 = 2199	2014	–	Excess tissue	+
17/AD	26.30	46	General	1246 + 2700 = 3946	2014	–	–	–
18/EA	32.44	47	General	1164 + 2000 = 3164	2014	–	–	+
19/FU	43.66	37	General	3118 + 1900 = 5018	2014	–	–	+
20/MT	29.14	68	General	2110	2014	–	–	–
21/ED	32.44	41	General	2900 + 2450 = 5350	2014	–	Suture dehiscence	+
22/BA	27.77	64	General	1660 + 550 = 2210	2014	–	–	–
23/SY	28.13	29	General	1483 + 650 = 2133	2015	–	–	–
24/MÖ	35.26	40	General	2424 + 1350 = 3774	2015	Cardiac disease	–	–
25/KS	34.11	50	General	1610 + 625 = 2235	2015	–	–	–
26/FB	35.16	64	General	2410 + 1500 = 3910	2015	–	Left partial areola loss and hematoma	+
27/FY	33.15	51	General	2885	2015	–	Total necrosis of the left areola	+
28/ŞM	27.59	54	General	1355 + 1350 = 2705	2015	–	–	–
29/AA	34.63	36	General	1355 + 800 = 2155	2015	–	–	–
30/ZŞ	29.00	52	General	1375 + 1050 = 2425	2015	–	Fat necrosis and excess tissue	+
31/AA	34.63	29	General	2510 + 1020 = 3530	2015	–	–	–
32/AC	40.40	51	General	3750 + 900 = 4650	2015	–	–	–
33/BA	26.57	29	General	2868	2015	–	–	–
34/ŞS	32.46	49	General	2058 + 700 = 2758	2016	–	–	–
35/EN	33.33	59	General	1816 + 950 = 2766	2016	–	–	–
36/ZA	26.8	36	General	2868 + 1300 = 4168	2016	–	–	–
37/FG	24.12	39	General	2057	2016	–	–	–
38/SG	38.86	42	General	2232 + 1135 = 3367	2016	–	–	–
39/MC	36.33	23	General	2380 +1350 = 3730	2016	–	Partial necrosis of the left areola	–
40/RY	25.71	62	General	2380	2016	–	–	–

Meticulous hemostasis is necessary to avoid hematoma formation, which may be hazardous to flap circulation. After resection is completed, the areolar flap is folded in and set into the new areolar opening (Fig. 10). Then, the lateral and medial pillars are united at the midline with three or four 2/0 Vicryl sutures to cover the areola pedicle
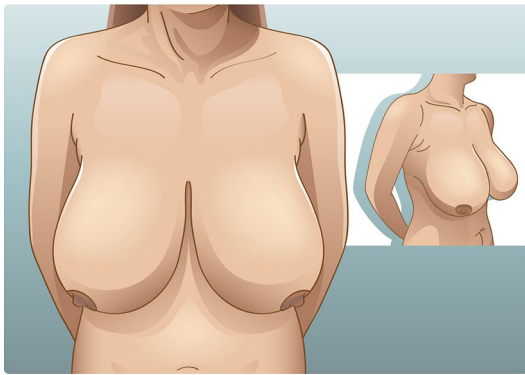
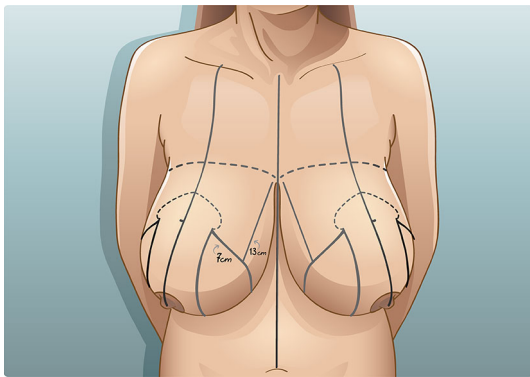Fig. 1 Preoperative markings are made in the standing position

Fig. 2 Both breast bases were marked and measured (dashed line). Breast meridians from the clavicular point should bisect the breast mold. 7 cm is marked at the vertical limb and an imaginary line from this point to the breast base should be around 13 cm

(Fig. 10). The connection between the pillars should be free of tension. If the plans are correct, a back-cut should not be necessary to position the pedicle. The redundant skin at the inframammary fold is usually resected in a horizontal fashion (Fig. 11). Fixation sutures between the glandular tissue and pectoralis fascia allow for a good inframammary fold (Fig. 12) and prevent tissue ptosis. Unless the patient is very young and has good skin elasticity, a secondary operation is unavoidable if a vertical scar is chosen and redundant tissue is left in place at the inframammary fold. In addition, a vertical scar can be excessively long at the inframammary fold and may be embarrassing to patients (Fig. 13).

Results

The mean operation time was 2 h and 50 min. The mean follow-up period was 2.4 years. The weight of resected specimens ranged from 2050 to 5398 g, with a mean of 3066 ± 944 g. No malignancy was detected on pathological examination of the resected tissues.
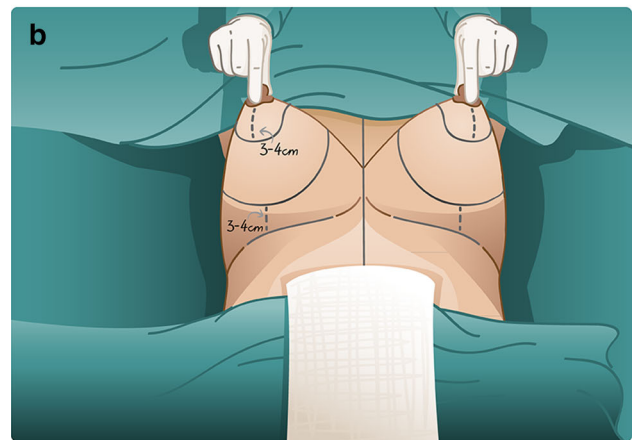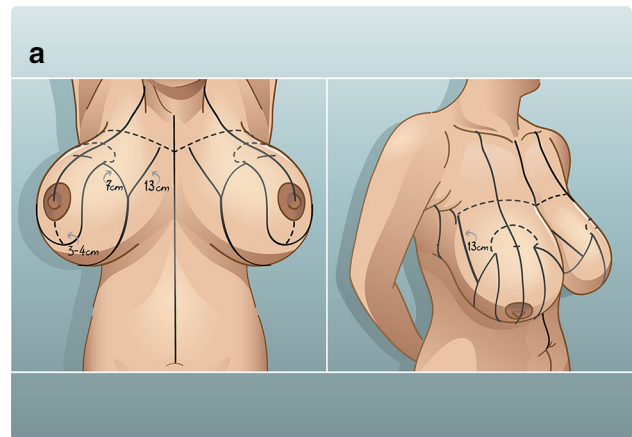

Fig. 3 a, b The caudal border of the areola pedicle to be epithelialized should extend at least 3–4 cm down to the areola. Inferiorly, at the midline, a line 3–4 cm above and parallel to the submammarian fold is drawn. This is the inferior limit of glandular and skin resection
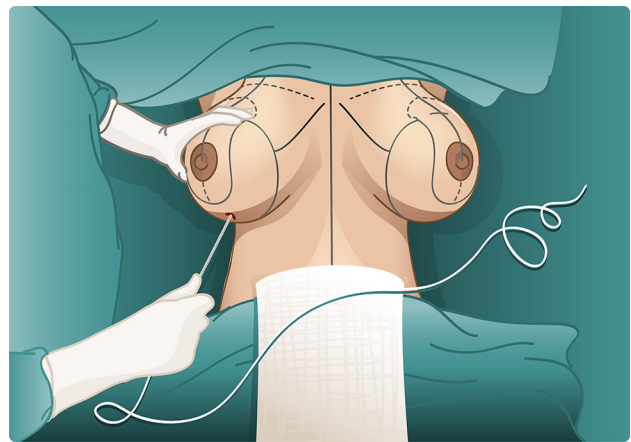

Fig. 4 Liposuction is performed for all parts of the breast

Rapid and significant improvement of physical symptoms and functional impairment was observed. Patient satisfaction with the shape of the breasts was high. The mean satisfaction score was 4.65. The technique provided good projection during the early period. Although
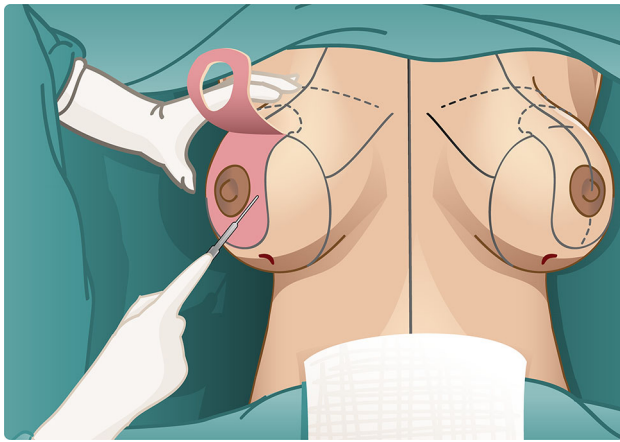
Fig. 5 The periareolar skin is deepithelialized

bottoming-out deformities were not a primary concern, the initial elasticity of the skin and inner structural support of the breast highly affected the resultant shape during the late postoperative period. Satisfactory long-term results were achieved for patients with better skin elasticity and tighter breasts (Fig. 14a, b). Ptosis recurred in cases with inelastic, thin skin and poor support (Fig. 15a, b).

Of the 40 patients in this study, two patients had partial areola necrosis and one patient had total areola necrosis. Seven patients underwent another operation due to skin redundancy (17.5%). Liposuction was performed for 29 of the 40 patients. In three cases, although attempted, liposuction could not be performed due to diffuse fibrocystic disease of the breasts. One patient with total areola necrosis had this condition, and we believe the tightness (inelasticity) of the breast compressed the pedicle and compromised circulation (Fig. 16). One case with partial areola necrosis was complicated with hematoma which required drainage. The other eight cases had very lax skin (long, ptotic breasts) that allowed for easy molding of the parenchymal tissue without liposuction.

Discussion

Reduction mammaplasty is one of the most frequently performed plastic surgery procedures to treat giant breasts. Different techniques have been developed in an attempt to achieve acceptable aesthetic results. One of the most important factors affecting the appropriate technique for breast reduction is the surgeon's experience and preferences. We have been using the superior pedicle for breast reductions for more than 15 years.

In the long term, the shape of the breast may be influenced by bottoming out or pseudoptosis due to the pedicle, and currently there is still a need for a reproducible and
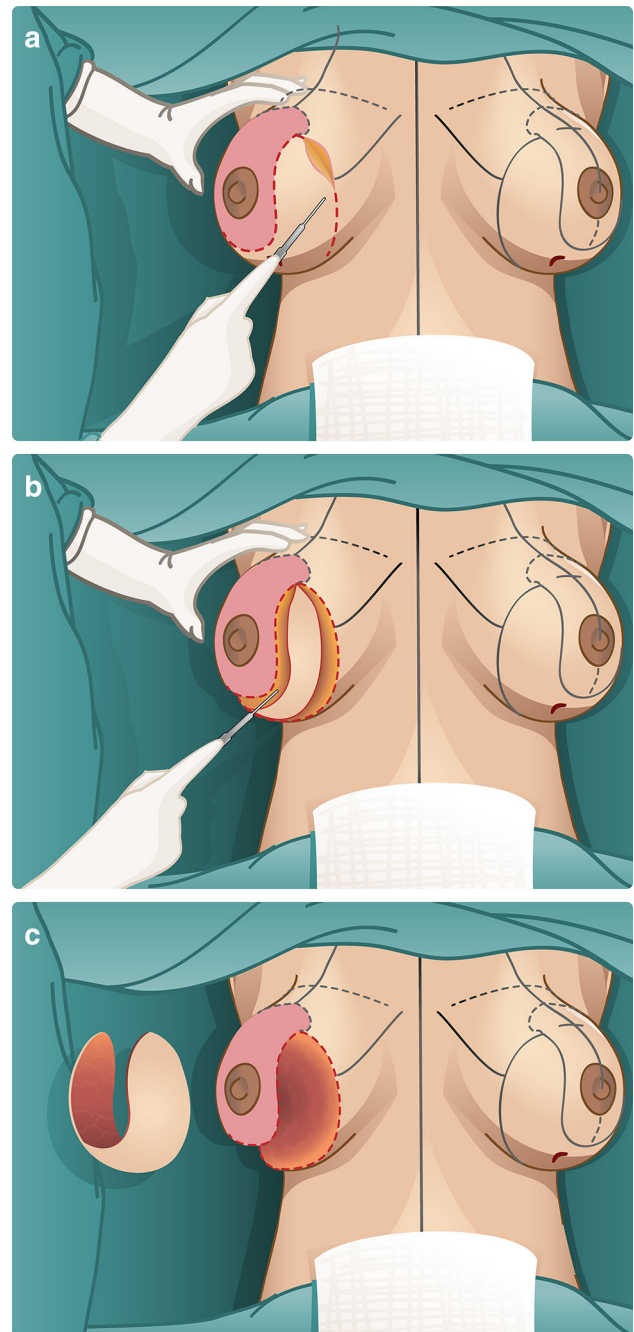

Fig. 6 a–c The crescent-shaped parenchymal tissue and skin is resected

reliable technique to create small breasts for patients with gigantomastia.

The technique described here combines liposuction, a superior pedicle nipple–areola complex (NAC) flap, and central and inferior glandular resection to achieve smaller breasts. Although some anecdotal case reports using this technique appeared in the literature [12, 13], to our knowledge, this is the first work that describes the technical
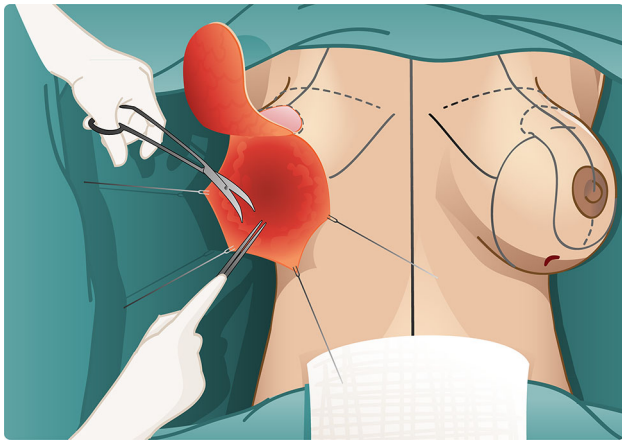
Fig. 7 The central breast tissue should also be removed, and the areola flap should be thinned to achieve a small-sized breast

Fig. 8 The thickness of the pedicle should be around 1.5–2.0 cm to allow for easy folding

Fig. 9 To obtain good projection, extra fat tissue may be left at the base of the pedicle (indicated with an arrow)

Fig. 10 Folding and inset of the pedicle, approximation of the pillars

aspects of this treatment and reveals the reproducibility and reliability of the technique.

Liposuction is a well-known technique for breast reduction. It can be used independently or combined with resection techniques [14, 15]. In this case series, 27 of the 40 cases underwent a high volume of liposuction in all quadrants of the breast until the breast tissue and surrounding skin became loose. Although previous reports of liposuction techniques for breast reduction avoided suctioning of the pedicle [14], we believe this is required, especially for long pedicles, to ensure easy folding and inset. Further, suctioning of fat harms pedicle circulation less than direct fat excision.

In three cases in this series, liposuction was attempted but could not be performed due to diffuse fibrocystic

disease of the breasts. The patient with total areola necrosis also had this condition, and we believe the tightness (inelasticity) of the breast compressed the pedicle and compromised circulation. The other 10 cases had lax skin that allowed for easy molding of the parenchymal tissue without liposuction. After liposuction, the breast is smaller, softer, more pliable, and easier to shape (Fig. 17). For effective reduction, the inferior portion of the breast should

Fig. 11 The redundant skin at the inframammary fold is usually resected in a horizontal fashion
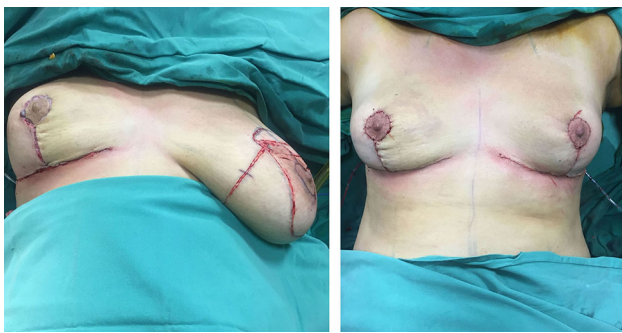

Fig. 12 Nicely created new inframammary folds by fixation sutures between the glandular tissue and pectoralis fascia

Fig. 13 If a vertical scar is chosen instead of a T scar, it can be excessively long at the inframammary fold

Fig. 14 a Long-term good projection (minimal ptosis) in a patient with good skin elasticity, anterior view, **b** oblique view

Fig. 15 a Recurrent ptosis in a patient with inelastic and thin skin, anterior view, **b** oblique view

be amputated and the thickness of the superior part of the breast as well as the medial and lateral pillars should be reduced.

Liposuction prevented undue compression of the pedicle in giant breasts. Additionally, correction of asymmetric breasts was easier after a high volume of fat aspiration was removed from the larger breast (Fig. 18).

The superior dermoglandular pedicle technique of breast reduction and its results in 193 reductions were reported by Robbins and Hoffman [10]. In this series, an overall nipple

slough rate was 5% (and a major slough rate of 1.4%), with 3% of patients needing intraoperative conversion to a free nipple–areola graft due to vascular issues [10]. In our
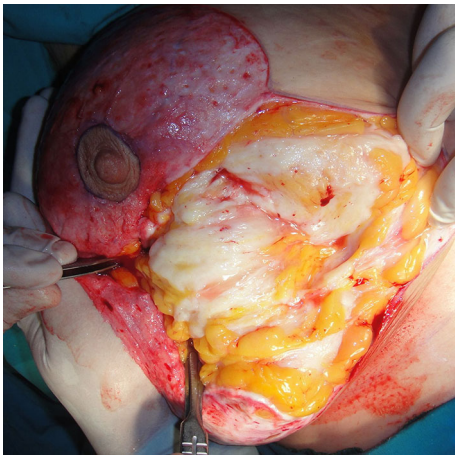
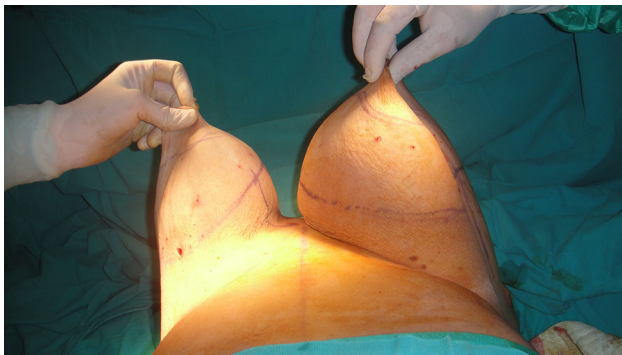**Fig. 16** Inelasticity and firmness of the fibrocystic disease of the breast

Fig. 17 By liposuction, the breasts become easier to manipulate and shape, also become softer and more pliable

Fig. 18 Liposuction is also useful in symmetrization of asymmetric breasts

patient series, the rate of partial areola necrosis was 5%, and the rate of complete areola necrosis was 2.5%. These rates are comparable to those in the literature.

Although no critical pedicle length has been set as a cutoff for free nipple grafting, Hammond and Loffredo [16] proposes that the technique be performed only for cases requiring resection of more than 1000 g per breast. In addition, NAC grafting is associated with loss of NAC sensation, lack of nipple projection, nipple hypopigmentation, and loss of lactation. Thus, it should not be performed on women of childbearing age who plan to breastfeed or women who want to preserve nipple sensation and erection. Although sensation was not quantified in this case series, our technique provided superior results in terms of nipple color homogeneity, projection, and erection. For one patient who gave birth after her breast reduction, lactation was possible but insufficient to feed the baby.

Nourishment and sensation of the NAC were maintained using a dermal pedicle in reduction mammaplasty in Schwarzmann's study, which reported that the NAC was an integral part of the skin on the anterior chest wall [17]. He noted that blood was supplied to the NAC mostly from internal mammary branches, intercostals, and acromiothoracic and axillary vessels [18, 19] through a very large dermal plexus. Although there are concerns regarding the safety of superiorly based pedicles, Lejour [20] stated that the upper pedicle of the areola is larger in larger breasts, making the procedure safe for all sizes of breasts. Nahai and Nahai [21] proposed that this technique be used for non-smokers with moderately large breasts and elastic skin, noting that an experienced surgeon may apply this technique to all breast types, regardless of size or skin elasticity. Russell reported that the primary determinant of nipple viability is the preservation of inferior perforators from the chest wall, and not the length of the dermal pedicle [6].

This study showed that the length of the NAC flap pedicle is not important during planning and is not a predictor of flap reliability. In this case series, we did not measure the distance between the sternal notch and nipple. Rather than the length, as Lejour stated earlier, the "width" of the pedicle is important [20]. The medial and lateral pillars were not undermined to protect perforators from the chest wall. However, unlike in Russell's study, the inferior perforators were sacrificed and undermining was performed superiorly underneath the pedicle. We believe the pressure over the pedicle inside the breast cone is a major factor determining the resultant circulation of the NAC flap. Folding of the long pedicle is not an issue if the newly formed breast cone does not compress the pedicle. One case of NAC partial necrosis included hematoma that disrupted the flap's perfusion and complicated the outcome. While performing the superior pedicle technique, to minimize the probability of NAC and necrosis, one should leave adequate (3–4 cm) tissue distal to the NAC and avoid hematomas and tight closure, which may further compress the pedicle. Three or four sutures should be adequate to approximate the medial and lateral pillars. If the sutures are tight and tear out fat tissue, this may indicate pedicle compression and fat necrosis. In two of the 40 cases, thoracic epidural anesthesia was performed reliably. This can

be an option in gigantomastia cases in which general anesthesia is not preferred.

Gravity (breast weight) and tissue dynamics (skin and gland quality) are the most important biologic factors affecting the normal profile of the ideal breast cone. The remaining breast parenchyma that is preserved inevitably descends due to the effect of gravity after a few months, causing the distance from the nipple to the inframammary fold to increase and leading to bottoming out and upward distortion of the plane of the NAC of the reduced breast [22]. The quality of the collagen tissue within the fat and glandular compartments determines postoperative breast ptosis. Our study shows that the rate of this late deformity is acceptable without the need for internal support materials or dermal suspension sutures. Late postoperative results were more satisfactory for younger patients. However, all age groups' satisfaction scores were high and no patient complained of flat breasts.

The complication rates in our study were comparable to those in the literature. Although two cases of partial necrosis and one case of total necrosis were encountered, we did not observe any cases of bilateral necrosis. Successful reconstructions were performed using labia majora skin and local tissue. A major late complication necessitating reoperation was skin redundancy in the inframammary region. Instead of a vertical scar, we believe that a T-shaped scar is a better option for avoiding secondary operations caused by poor secondary skin contraction.

The precise etiology of gigantomastia remains unknown; however, many mechanisms have been suggested, including hormonal abnormalities, hormone receptor hypersensitivity, malignancy, drug induction, genetics, and autoimmunity [5, 23, 24]. No etiological investigations were performed here, but interestingly, the body mass index (BMI) of our patients indicated that they were either overweight (13/40) or obese (25/40) (Table 1). Although anthropometric studies of breast volume among adult women are lacking and the exact incidence of macromastia is not known, in my country, breast reduction is one of most widely performed cosmetic procedures. One conclusion that can be drawn from our study is that BMI is an important factor affecting breast size and can be associated with complications caused by breast reduction.

One drawback of our article is there is no group for comparison. Scientific value would be enhanced if we could have compared our results with a free nipple or inferior pedicle group which are commonly performed for gigantomastia reductions.

Conclusion

A superior pedicle with or without liposuction can be reliably performed in gigantomastia cases. Small breasts with enhanced aesthetics can be achieved. A T scar is a better option to deal with the horizontal skin redundancy at the inframammary fold because secondary contraction of the skin is poor. Immediate and long-term results are satisfactory with rapid improvement of the physical complaints and good breast projection.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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