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Upper-Body Lift and Breast Reshaping With Lateral Chest Wall Perforator Propeller Flap Following Massive Weight Loss

Le body lift supérieur avec reconstruction mammaire par lambeaux perforants latéro-thoracique en hélice chez les patients après perte de poids massive.

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Introduction

Recently, the number of body contouring procedures following massive weight loss (MWL) continued to increase dramatically. Along with metabolic benefits, women with MWL commonly present several body shape deformities consisting, at the level of the upper trunk and arms, of an excess skin sagging in the axilla area, the medial arms [1–4]. and an upper trunk redundancy which is not correctly treated by abdominoplasty or lower bodylift.

Massive weight loss is frequently associated to a major alteration of the breasts characterized by a reduction in volume and poor shape projection, ptosis, loss of skin elasticity and often an inferolateral slip of the inframammary fold (IMF).

To treat these complex deformities in one stage, the plastic surgeon can perform an upper body lift (UBL), usually described as a single procedure combining an excision of the upper back and lateral skin excess with other procedures: a reverse abdominoplasty and/or a mastopexy and/or a brachioplasty, resulting in a scar placed in the bra line [5,6] or in the midaxillary line [7,8].

After MWL, breast deformities management can be a real challenge, and the traditional techniques, such as the use of breasts implants [9] to restore an aesthetically pleasing and durable breast shape, present sometimes unpredictable outcomes [10–12].

During the last decade, some authors have described a procedure using the local skin excess of the lateral chest wall with a fasciocutaneous perforator flap reconstruction for reshaping the breasts. This autologous breast augmentation in the post-bariatric population has been described in the literature, such as the total parenchymal reshaping [13], the spiral flap [14] and techniques using lateral intercostal artery perforator flaps [10,15,16] or anterior intercostal artery perforator flaps [12]. However, the aforementioned procedures have been performed singly or in conjunction with one or maximum two other torso-plasty procedures

[14,17] to treat the different areas of the upper torso laxity. Thus, this technique is based on several studies investigating the anatomy of perforators originating from intercostal, lateral thoracic and thoracodorsal arteries [15,18–20], and benefits from the characteristics of the nutrient blood vessels in the patient's excess tissues which have become enlarged and more robust with the development of a large body habitus [10,17].

In our series, to achieve a better circumferential upper body contour improvement and to enhance the breasts size and shape, we chose a combined approach named "total UBL" associating breast reshaping with perforators propeller flap with a brachioplasty, back rolls removal and a reverse abdominoplasty. All these techniques are performed simultaneously in one single procedure.

We review our early experience with "total UBL" in MWL women patients and discuss the indications, results and complications of this procedure.

Methods

Patients

We performed retrospective analysis of all patients who underwent UBL between September 2015 and March 2017 in our department including age, sex, medical history, body mass index (BMI), and weight loss. Data on the surgery included operative time, areas resection location, data on flap harvesting, duration of hospitalization and post-operative complications following the classification of Dindo and Clavien [21]. Physical examination was performed 1, 3, 6, and 12 months after surgery. At follow-up, the patients were asked to informally evaluate their aesthetic outcome with a five-points scale (5 = excellent result, 4 = good result, 3 = fair, 2 =decent, and 1 = poor). In parallel, we asked external plastic surgeons (n=4) to

evaluate the aesthetic outcome on preoperative and one year postoperative pictures with the same five points scale.

This study was approved by our institutional review board and performed in accordance with the principles of the Declaration of Helsinki and French bioethics laws of July 7, 2011.

Surgical Procedure

Pre-operative drawing

The patient was marked preoperatively while standing up. We started by marking the backs rolls, if any, with a resection area determined by pinch test. The scar did not cross the median line [14,22]. The drawings were planned in continuity with chest markings so that all the scars would be hidden by a bra.

If a brachioplasty had to be associated, the markings were made according to a L-brachioplasty technique [23].

The lateral chest cutaneous excess was assessed by pinch test and marked with a vertical or horizontal ellipse (when back rolls were present), to be used as a propeller perforator flap based on the lateral intercostal artery perforator (LICAP) or/and lateral thoracic artery perforator (LTAP) for breast augmentation. The axis of the flap was generally centred on the mid axillary line, the scar aligned with a simultaneous or an old brachioplasty incision.

Then, a reverse abdominoplasty was performed using a superior traction of the upper abdominal wall tissue immediately beneath the IMF and determining the amount of skin to be resected [24].

The markings were completed by a drawing of an inverted-T superior pedicle mastopexy [25]. The breast incisions lines should be drawn conservatively, anticipating the added volume of the flaps (Fig. 1).

A hand-held doppler ultrasound was rarely used to find the lateral chest perforators.

Operative Technique

After preoperative antibiotics were given, we started in prone position by the back rolls, if any (n=2). A skin incision of the marks was performed after verifying the wound could be closed. All the redundant skin was resected. Closure was achieved without tension after a drain placement using absorbable sutures (**See Figure, Supplemental Digital Content 1, which shows "Back Rolls Removal"**).

Then, surgery continued in supine position with both arms abducted to 90°. A brachioplasty was carried out after infiltration of the excision site with adrenalin saline solution (1/1000 dilution). Firstly, we performed a liposuction under the skin resection area to conserve the connective tissue such as the microvascular network [26] The skin was checked preoperatively, resected, then closed without tension by absorbable stitches without drainage. At the level of the axillary region, the end of the brachioplasty scar was aligned with the scar of the lateral chest wall. (**See Figure, Supplemental Digital Content 2, which shows "Brachioplasty"**).

At that point, we harvested the perforator flap. The skin paddle of the flap was de-epithelialized. Thereafter, a perforator vessels dissection was performed under the muscular fascia. Between the latissimus dorsi (LD) muscle and the lateral border of the major pectoralis (MP) muscle, all sizeable perforators were spared until we found a similar or larger vessel closer to the projection of the IMF and the external edge of the MP muscle. The flap was harvested upon the lateral thoracic or lateral intercostal best calibres perforators vessels. When the perforator was chosen, the flap was harvested subfascially from cranial to caudal.

Next, a lateral retroglandular pocket was created. We verified that the flap could be introduced as far as the upper pole without any tension on the perforators. The flap was thus rotated at 90° (n=7), or 180° (n=2) and anchored by three absorbable stitches through the de-epithelialized dermal borders of the flap and the pectoralis major fascia. The donor site of the flap was closed over a suction drain (**See Figure, Supplemental Digital Content 3, which shows "The propeller LICAP Flap"**).

Afterward, we performed the reverse abdominoplasty with a small undermining of the upper abdomen. The abdominal flap was anchored at the position of the neo IMF by non absorbable stitches, medially by a transcostal point and laterally by a periostea point. **(See Figure, Supplemental Digital Content 4, which shows "Reverse Abdominoplasty"**).

Finally, an inverted skin T-mastopexy technique was performed to obtain better breast reshaping over the flaps augmentation. Before incising, a pinch test was performed to ensure the skin could be closed safely. The Nipple-Areola Complex was lifted up depending on a superior pedicle to facilitate its closure without tension. The lower de-epithelialized breast segment was fixed to the muscular fascia by a "U" stitch of absorbable suture. The new infra mammary fold, previously defined by fixing the upper abdominal flap to the thoracic wall, was closed in several layers (Fig. 2). (**See Figure, Supplemental Digital Content 5, which shows " Skin mastopexy technique"**).

Results

Finally, nine "total UBL" were performed successfully. The mean age of the patients was 45.3±8.9 years. They all had sustained gastric bypass. Eight had already undergone a lower

body contouring surgery, two had had a brachioplasty, and seven presented a skin ptosis of the upper arms. Back rolls resection was performed on two patients presenting upper back tissue excess. None of these patients had any major medical condition that might have been a contraindication for a longer surgical procedure. The mean pre-MWL BMI was 54.3±10.9 kg/m2, with a mean preoperative pre-UBL BMI of 28.7±3.6 kg/m2 and a mean preoperative weight of 77.3±9.9 kg. The average weight loss was 67.7±22.4 kg. The follow-up of the patients ranged from 13 to 37 months with a mean of 27.9±8.4 months (Table 1).

The average flap dimension was 16.8 x 9.7 cm, with a mean surface of 165.3±41.8 cm². Usually, the flaps were harvested on a mean of 3.6±1.0 perforators for each side. On the 18 flaps, 13 originated from the intercostal artery and 5 from the lateral thoracic artery. For seven patients, the flaps were harvested parallel to the anterior axillary line and introduced in the retroglandular space with a rotation of 90°, whereas, for two other patients, the flaps were harvested parallel to the IMF and so introduced with a rotation of 180°.
The mean operative time was 7.4±0.8 hours. The procedures were systematically performed bilaterally by a double-team to reduce operative time.

In this series, according to the classification of Dindo and Clavien [21], three grade I complications (small breast dehiscences at the T point and a breast site seroma), one grade II (an hypertrophic scar on the midline), and two grade IIIb complications (one immediate breast hematoma and one delayed epigastric hematoma, requiring an operative evacuation) occurred. One patient required a red blood cells transfusion following a hematoma. No flap necrosis, wound infection or thromboembolic complications appeared (Table 2).

Mean hospital admission was 8±1.9 days. The drains were left till under 20 cc allowing patient discharge.

Overall, all the scars were well hidden in the bra-line and were cosmetically acceptable to all patients (Fig.3). The mean of the aesthetic outcome was ranked 3.8±0.8 (of 5) for the patients and 3.4±0.6 for the external plastic surgeons. Thus the patient satisfaction with the improved shape and size of their breasts and the chest wall contours was generally "good".

Discussion

The management of the upper deformities after MWL is less well codified than the management of the lower body contouring. For women, breast deformities are an essential reconstruction objective.

These breast deformities are not addressed with only mastopexy techniques. Although the use of breast implants may seem attractive, whether for the surgeon or the patient, the outcome often proves quite disappointing, especially with the need for submuscular placement to cover the upper pole of the implant. In the mid-to long-term, parenchymal ptosis is frequently observed above retro muscular implant along with implant migration plus all the complications inherent to implants: risks of leakage, rippling, rupture, infection, capsular contracture, and malposition [11,27,28]. In addition, the cost may become prohibitive with the need to change them periodically.

To avoid these complications, we experimented with perforator flaps for breast reshaping which seemed a good natural option. In this approach, a free flap breast reshaping technique has been described, such as bilateral breast augmentation with a transverse gracilis myocutaneous free flap [29]. However, to achieve an optimal result without free tissue

transfer, the latest trend is to perform autologous breast augmentation by pedicled fasciocutaneous perforator flaps harvested from the lateral chest wall redundant tissue which would otherwise be discarded as a result of body-contouring surgery.

These lateral thoracic perforator flaps based on intercostal [30–32] or thoracodorsal [33] arteries were first used in breast reconstruction to correct partial lateral mastectomy defects. Then several anatomical studies [15,18–20] investigated the anatomy of these vessels and demonstrated that large extended lateral fasciocutaneous perforator flaps might be designed and harvested safely [15,18,20]. Furthermore, in this post bariatric population, large vessels are frequently encountered in their excess tissues and seem to retain their large calibre after massive weight loss [10,17].

Using this knowledge, Hurtwitz and Agha-Mohammadi [14] were the first to perform a deepithelialized fasciocutaneous flap extended on the lateral side of the breast, called "Spiral flap", which was supplied by intercostal, lateral thoracic and pectoral perforators, combined to a Wise-pattern mastopexy and a reverse abdominoplasty for contouring the breast and chest. Then, Kwei et al [9] carried out a similar technique on 5 patients. Rubin and Khachi [13] also confirmed their own experience with a similar lateral chest wall perforator flap using the principles of dermal suspension for auto augmentation of the MWL breast. Founded on their anatomic study [18], Hamdi et al introduce the term of "LICAP flap" by harvesting the lateral redundant side rolls as an island perforator flap, associated with a vertical design mastopexy [16]. Thornton [11] harvested this LICAP flap, according to a vertically oriented pedicled transposition flap from the axillary skin roll, to address the problem of both lateral skin excess and insufficient breast volume., Akyurek [34] described a LICAP flap autoaugmentation secured under a pectoralis muscle sling to prevent the descent of the flap. Finally, Patel and

Wong [17] performed 13 extended lateral fasciocutaneous flaps for autologous breast augmentation combined to an UBL with the scar in the bra line or a "modified UBL" where the scar is along the midaxillary line.

For our team, all combined procedures which include at least a breast reshaping and an upper abdominal contouring with a brachioplasty and/or back rolls resection are a total UBL. In this study, we demonstrate that a total UBL with lateral chest wall perforator propeller flap was feasible and safe with no major event. Nevertheless, MWL patients may have many comorbidities that may contraindicate long surgery and increase the potential postoperative wound healing problems. Therefore, this approach cannot be intended without due preoperative medical consideration and a good patient selection.

In our series, we performed systematically a dissection of the vessels, and if needed a skeletonization through the muscle, contrary to the majority of studies [11,13,14,17,34] where the fasciocutaneous flap were harvested and transferred within a turnover flap design. Despite the fact that perforators dissection is not necessary if the flap can easily reach the retroglandular space, this dissection aims to decrease the risk of kinking vessels, to increase the arc of rotation, the mobility of the flap, and to avoid the excess tissue at the pivot point. Thus this process allowed us to suture the flap to the pectoralis fascia without tension into the retro glandular pocket to prevent the descent of the flap, and so to obtain a greater fullness of the superior pole and a better definition of the lateral breast border. Moreover, a large volume autoaugmentation flap can be harvested safely [10,18]. On the other hand, this dissection of the perforators generally increased operative time. However, as Persichetti [12] demonstrated, the time increase was not significant on the overall classic mastopexy procedure. The flap

harvesting enabled to treat the axillary excess in continuity with the arm excess. That is why, in our opinion, brachioplasty must be performed at the same time to achieve better contouring.

The next area that must be considered is the upper abdominal redundancy tissue and skin, which is generally not treated by a conventional abdominoplasty. In 1979, Baroudi et Al [35], described for the first time the association of procedures to redefine the breast's shape by a mammary reduction and improve the upper trunk contour by a reverse abdominoplasty using the same incision. Then, Pacifico et al combined a reverse abdominoplasty with an autologous breast reshaping technique, using for breast augmentation the upper excess abdominal tissue would be normaly be excised [36]. In our report, we performed a tensioned reverse abdominoplasty [24]. Then, we carried out an anchoring of the upper abdominal flap by deep-tension sutures into the costal perichondrium and costal periosteum of the abdominal wall to recreate and secure a neo-inframammary fold and to prevent the down migration of the abdominal flap and thus of this néo-IMF.

Although the intermammary region is known for bad scarring, we noted just one hypertrophic scar in a patient with risk factors. This was solved with intralesional steroid injections. Otherwise, thanks to the distribution of the tensions of the upper abdominal flap on the thoracic wall, this midline scar was well tolerated by patients and no other problematic scarring was found.

Despite the very long operative time, these combined approaches allow to lessen the number of hospitalizations and associated costs needed for MWL patients.

In this article we presented one of the biggest series of upper body contouring using a "total UBL". However, the drawback of the combination of these procedures is its duration, with a mean of 7.4 h and also a longer hospital stay with a mean of 8 days, in our series. As it is known, large dermolipectomy procedures, in MWL population, often present perioperative complications [37,38]. Consistent with these studies, we had a tolerable complication rate in our series, particularly no flap necrosis. We attribute our complication rate to difficulties inherent to the learning curve. Generalizing the results of these series should be met with caution.

Another point to be discussed, is the fact that despite a good anchoring of the upper abdominal flap, we have observed at one year postoperatively in some cases a down migration of the néo-IMF (fig. 1c) and the reappearance of a moderate breast ptosis (fig. 3d). This instability of outcomes is due to poor skin tone which makes these reconstructions difficult with disappointing results.

Even though we have not performed in our study any comparison of pre and postoperative breast volume, the degree of augmentation using autologous flaps to improve breast shape is limited, especially if the patients present poor lateral excess tissues. In this case, to avoid the use of breast implants and to obtain an autologous and satisfying breast volume, a breast lipofilling can be performed afterwards [39].

Another point must be underlined, about breast cancer screening. Of course, in all patients, a preoperative breast assessment by clinical examination, and a mammographic and echographic screening were systematically performed. But, actually we do not know how the introduction of autologous lateral chest tissue may influence mammographic results. In

association with a post mammographic screening we recommended auto-examinations to our patients and furthermore we realized on the two first patients a MRI of the breasts at 1 year to verify that the flaps could be well differentiated from the mammary gland. Thus, on the MRI exam we could see clearly the limit between the flap and the natural breast tissue. (Fig.4)

Overall, patients greatly appreciated the possibility of treating several regions in one operation and were satisfied with their breast reshaping outcomes and the redefinition of their upper trunk. Moreover no complaint was made about the scars, which remained hidden in aesthetically acceptable locations.

Conclusions

The "total UBL" allows to perform simultaneously a reverse abdominoplasty, excisions of back rolls and an extended brachioplasty which improve breasts contour and the upper body circumferential shape. Although, the MWL patient usually required several procedures to address the whole upper body-contouring issues, this article shows that the upper body of the woman after MWL could be considered as a single unit and thus could be treated by a combined approach safely and reliably with only one procedure named "total UBL", obviously coupled to a careful patient selection.

Conflict of Interest:

Authors declare no potential conflicts of interest.

"Les auteurs déclarent ne pas avoir de liens d'intérêts."

Disclosures and Fundings

The authors received no funding support for this article "None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript."

Compliance with Ethical Standards

Ethical Approval Statement

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

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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Table Legends:

Table.1: Patient Characteristics and Follow-Up

Table.2: Results of flaps surgery and Complications

Figure Legends:

Fig. 1

(A,B) Anterior and right anterior oblique views of a 33 years patient (patient "2" in tables) with immediate preoperative surgical markings for an UBL and lateral chest wall propeller perforator flaps. **(C,D)** Anterior and right anterior oblique postoperative views 1 year after the procedure which included a breast reshaping with perforators propeller flap with a brachioplasty, and a reverse abdominoplasty. No dorsal skin excess needed to be treated in this patient.

Fig. 2 :

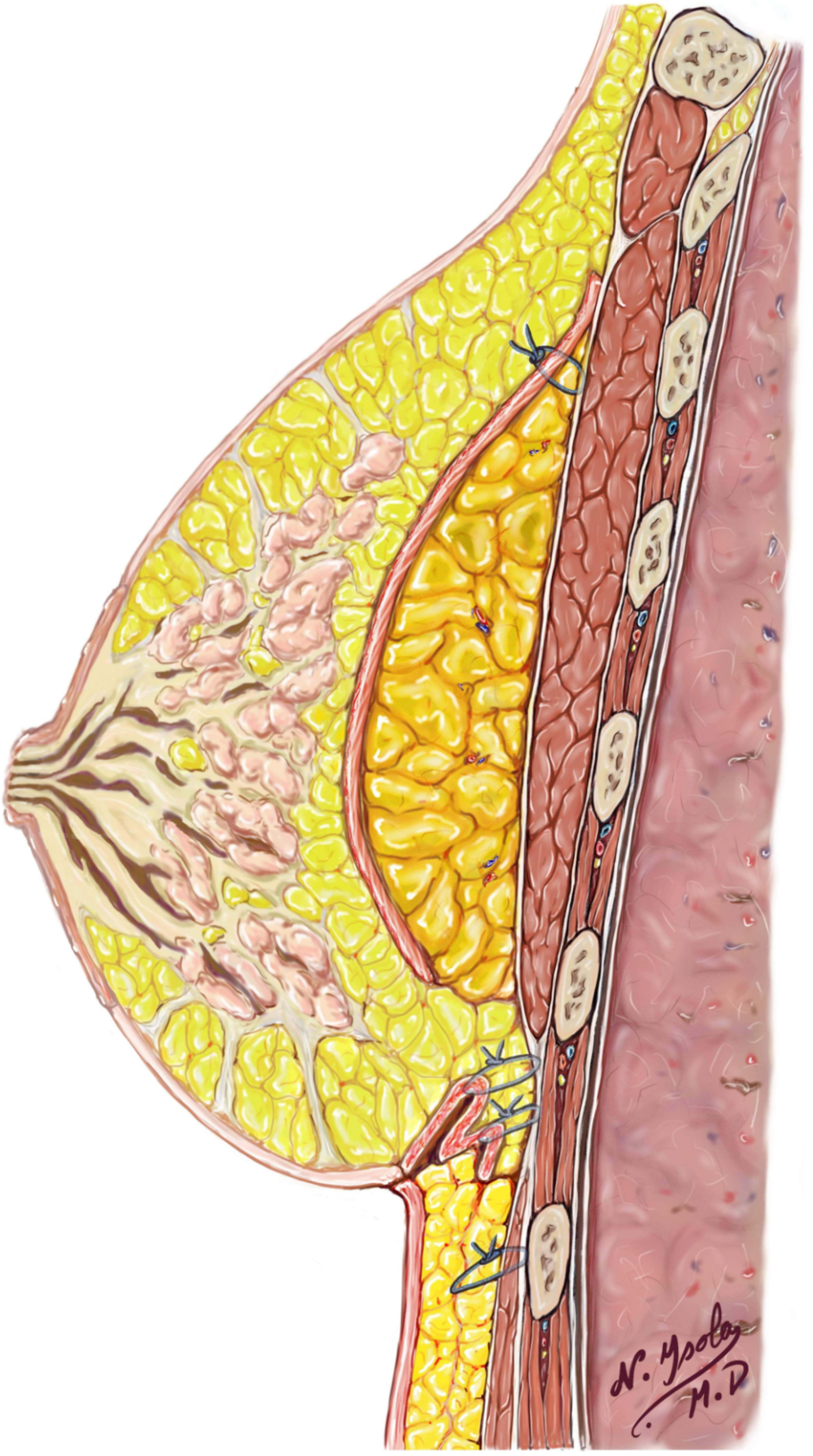
Sagittal section illustration of the breast. The perforator flap is secured by absorbable stitches through the de-epithelialized dermal borders of the flap and the pectoralis major fascia. The neo-IMF is defined by a plication of the de-epithelialized lower breast segment and the anchoring of the upper abdominal flap. The both were fixed to the rib's periosteum by non absorbable sutures.

Fig. 3:

A 42-years old woman with a weight loss of 71 kg, one year after her brachioplasty (patient "6" in tables)**. (A,B,C)** Preoperative photographs of this patient who presented severe skin redundancy of the upper trunk and persitance of excess sagging tissues of the upper arms even after her brachioplasty. **(D,E,F)** Postoperative photographs 1 year after a total UBL which included a breast reshaping by lateral thoracic perforator flaps, an abdominal contouring by

reverse abdominoplasty, a brachioplasty, and a resection of back rolls. The postoperative aesthetic result was rated good by the patient.

Fig. 4: Magnetic resonance image shows clearly the perforator flap under the natural breast tissue


N. Ysoba
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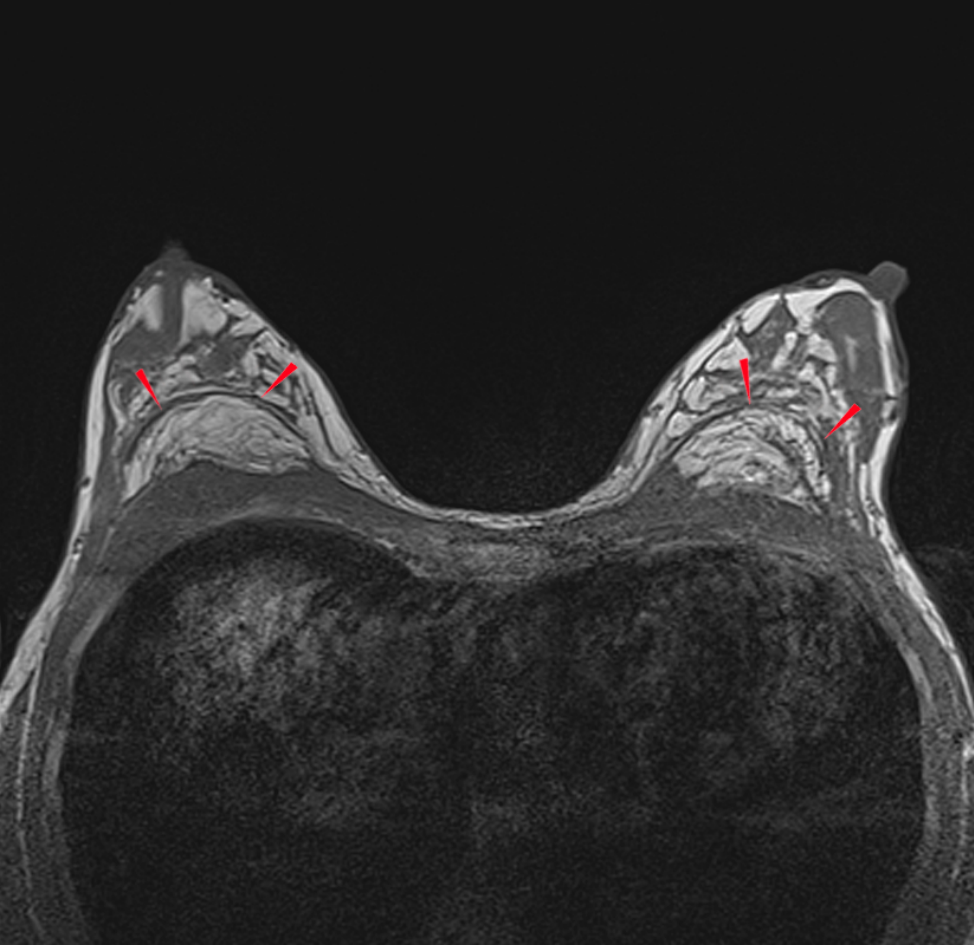

Table 1. Patient Characteristics and Follow-Up

Patient	Age (yr)	Bariatric Procedure	Weight (kg)	BMI (kg/ m^2)	Pre-MWL BMI (kg/ m^2)	Weight loss (kg)	Previous body contouring procedures	Follow-Up (mo)
1	61	GP	79	25,8	48,7	70	AD	37
2	33	GP	73	24,1	42,6	56	None	36
3	34	GP	73	28,5	48,8	52	AD	35
4	52	GP	60	26,7	80,0	120	LBL, MTP	32
5	41	GP	76	24,8	49,0	74	LBL, B, MTP	31
6	42	GP	72	29,6	58,8	71	AD, B	26
7	51	GP	80	30,9	57,5	69	LBL	22
8	47	GP	93	33,3	48,4	42	LBL	19
9	47	GP	90	34,3	55,3	55	LBL	13
Mean/ SD	**45,3±8.9**		**77,3±9.9**	**28,7±3.6**	**54,3±10.9**	**67,7±22.4**		**27.9±8.4**

GP indicates gastric bypass; BMI, body mass index; MWL, massive weight loss; AD, abdominal dermolipectomy; B, brachioplasty; LBL, lower body lift; MTP, medial thigh plasty; UBL, upper body lift.

Table 2. Results of flaps surgery and Complications

Patient	Flap dimensions cm	Flap dimensions cm²	No. of perforators by flap Right	No. of perforators by flap Left	Degrees rotation flaps	Total Operation time (h)	Complications/ Comments
1	19 x 10	190	4	4	90	7.08	Grade I : breast wound dehiscence and breast fat necrosis
2	16 x 10	160	4	5	90	8.7	Grade II : Sternal hypertrophic scar
3	19 x 12	228	4	2	180	7.9	Grade I: Small right donor site seroma
4	18 x 10	180	2	4	90	6.8	Grade IIIb: Late epigastric hematoma - evacuated, sagging scars underwent postoperative revisions
5	17 x 9	153	3	2	180	5.9	None
6	20 x 10	200	4	4	90	7.8	Grade IIIb: Immediate postoperative left breast hematoma - evacuated and blood transfusions.
7	17 x 9	153	2	3	90	7.5	None
8	10 x 8	80	4	4	90	7	Grade I: Small breasts dehiscence (2 x 2cm)
9	16 x 9	144	5	5	90	8.2	None
Mean / SD	**16.8 x 9.7**	**165.3±41.8**	**3.6±1.0**	**3.7±1.1**		**7.4±0.8**	

Classification of Dindo and Clavien :
Grade 1: Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Acceptable therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes and physiotherapy.
Grade 2: Requiring pharmacological treatment with drugs other than such allowed for grade 1 complications. Blood transfusions and total parenteral nutrition are also included.
Grade 3: Requiring surgical, endoscopic or radiological intervention. **Grade 3a**: Intervention not under general anesthesia. **Grade 3b**: Intervention under general anesthesia